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SPECIAL REPORT

ON

COAL:

Showing its Distribution, Classification and Cost Delivered over Different Routes to various points in the

STATE OF NEW YORK.

And the principal Cities on the Atlantic Coast,

BY

S. H. SWEET,

Late Deputy Engineer and Surveyor of the State of New York.

TRANSMITTED TO THE LEGISLATURE MARCH 15, 1865.

NEW YORK:

D. VAN NOSTRAND, 192 BROADWAY.

1866.

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State of New York.

No. 71.

IN SENATE,

March 18, 1865.

COMMUNICATION

FROM THE STATE ENGINEER AND SURVEYOR, TRANSMITTING A SPECIAL REPORT ON COAL.

STATE OF NEW YORK:
OFFICE OF STATE ENGINEER AND SURVEYOR,
ALBANY, *March* 18, 1865.

To the Hon. THOS. G. ALVORD,
Lieut. Gov. and President of the Senate:

Sir—I have the honor herewith to transmit to the Legislature a *Report on Coal*, showing its distribution, classification and cost delivered over different routes to various points in this State, and the principal cities on the Atlantic coast, as prepared by S. H. SWEET, late Deputy State Engineer and Surveyor.

Yours respectfully,
W. B. TAYLOR,
State Engineer and Surveyor.

ALBANY, *February 28th*, 1865.

HON. WM. B. TAYLOR,
State Engineer and Surveyor:

DEAR SIR—During the past summer I devoted my leisure time to the investigation of the subject of Coal—its distribution, classification and cost, delivered over different routes to various points in this State and the principal cities along the Atlantic coast. The length of routes to market, and the cost of transportation were determined with great care and are believed to be reliable.

The subject of transportation in connection with an article in such great demand cannot be too carefully considered. It is evident that every available route should be opened and every facility offered for cheapening transportation from the coal mines. The coal fields are practically inexhaustible, and the labor for mining abundant. Transportation is therefore the main item in connection with this growing necessity.

The mistaken policy of the State of Pennsylvania, in selling her canals, not only placed herself at the mercy and interests of private corporations, but by this act imposed heavy burdens upon the coal consumers of this and adjoining States—they being compelled to submit to the combinations of companies who connect the cheap with expensive routes of transportation. By this method the coal consumers are deprived of the direct benefits of canal transportation. In justice, Pennsylvania should impose restrictions upon these unjust monopolies.

With the view of throwing some light upon this subject, I have grouped together such facts, from the most reliable sources, as have appeared to have an important bearing on

this question, believing that thereby I might contribute something of substantial service to the public at large. I therefore submit the result of my labors to your judgment for such disposition as you may consider them entitled to.

For the cost of bituminous and anthracite coal (gold at par), see pages 30, 35, 38 and 46. The average cost of labor and materials have not increased since 1861 more than 100 per cent; hence, by doubling the cost, as shown in the tables referred to, gives the wholesale price of coal for 1864, delivered on the docks.

Upon this basis, and selecting to each place two of the cheapest routes, the following shows the average cost of coal per ton for 1864:

	Bituminous.	Anthracite.
New York	$7 68	$6 75
Albany	7 25	7 10
Utica	6 33	6 94
Syracuse	5 86	6 53
Rochester	6 09	6 94
Buffalo	6 86	7 70

Very respectfully,

Yours, etc.,

S. H. SWEET.

REPORT ON COAL.

ORIGIN, DISTRIBUTION AND CLASSIFICATION OF COAL.

To modern Geologists we are indebted for the key to the origin, distribution and classification of coal, and for systematizing and bringing directly into practical use many great and valuable discoveries that otherwise would have proved comparatively worthless.

Formerly, every Geologist formed his theory, based mainly upon his own discoveries; but more recent investigations have swept away all unsatisfactory conclusions, and brought the science into the one great channel of practical utility, by classifications into stratigraphical periods—each recognized by its own peculiar rocks, plants and animals.

Thus we find the coal measures only in the Carboniferous age—in the sixth period before the age of man, or half-way between that and the Azoic, or the age destitute of organic life. The formations of that age embrace sandstone, shales, limestone, conglomerates, together with beds of coal.

In the following Physical history of the Globe, (as arranged by Geologists,) the geological time of the formation of the earth's crust is divided into six great ages, viz: the Azoic, Silurian, Devonian, Carboniferous, Reptilian and Mammalian.

The first is characterized by all absence of organic or animal life; the second by the deposit of the salt beds; the third by fishes, growth of marine plants, and the deposit of Petroleum or Rock oil; the fourth by formation of the continents from the sea, the rank growth of fresh water plants, and the deposit of the

coal beds; the fifth by Reptiles, and the sixth the age of Man and quadrupeds.

The following are the sub-divisions of Geological time, and order of succession of strata composing the earth's crust, beginning with the Azoic, or age destitute of organic life.

2d. *Silurian or Age of Mollusks*—Embracing the Potsdam period (of Potsdam sandstone and Calciferous sand rock); Trenton period (of Chazy limestone, Trenton, Black River and Birdseye limestone); Hudson period (of Utica shale, Hudson River group); Niagara period (of Oneida conglomerate, Medina sandstone, Clinton group and Niagara group); Salina period (of Saliferous or salt beds); Lower Helderberg period (of Lower Helderberg group).

3d. *Devonian, or Age of Fishes and the Old Red Sandstone*—Embracing the Oriskany period (of Oriskany sandstone); Corniferous period (of Canda-galli grit, Schoharie grit and Upper Helderberg limestone); Hamilton period (of Marcellus shale and Hamilton group); Chemung period (of Portage group, Chemung group and Catskill red sandstone); Catskill period (of Catskill red sandstone.

4th. *Carboniferous, or Age of Coal Measures*—Embracing the sub-Carboniferous period (of Mountain limestone); Carboniferous period (of Millstone grit and the coal measures); Peruvian period (of red sandstone, marls and magnesia limestone).

5th. *Reptilian, or Age of Reptiles*—Embracing the Triassic period (of Connecticut River sandstone with foot-prints, Bunter sandstein, Muschelkalk and Kuper); Jurassic period (of Stonesfield slate, Oxford group, Portland stone, Purbeck and Wealden); Cretaceous period (of Greensand, lower and upper chalk, with flints).

6th. *Mammalian, or Age of Man and Quadrupeds*—Embraces the Tertiary and Post-Tertiary periods.

Origin of Coal.

Geologists have determined the vegetable origin of coal, but until of late years differed as to the deposits of the Carboniferous strata, in which triple deposits of coal are repeated three or four times through a thickness of many thousand feet.

In the Chemung period, immediately preceding the Carboniferous, all that existed of America was a line of hills from Nova Scotia to the far west, forming a long, narrow island—the Alleganies and Rocky Mountains not then in existence. Stratified

deposits were formed by gradual abrasion, leaving low, marshy lands with sand barriers, similar to the New Jersey sand-shores enclosing marshes. As rock oil is formed by distilling marine plants in confined bodies of salt water, this undoubtedly is the period when the bulk of this substance was deposited. The earth then, more than at present, underwent slow or rapid subsidence and upheaval, causing the ocean, in repeated successions, to burst the sand barriers, covering the rank, undecayed vegetation of the salt marshes with sand, thus excluding the atmosphere, and leaving the process to nature of distilling the sea-plants by the application of internal heat, the sand forming into rock preventing the escape of vapor. (For Petroleum, see Appendix E.)

The Carboniferous age (immediately succeeding the Chemung period) is that fixed by Geologists when the continents were formed by repeated upheavals, and characterized by the rank growth of fresh water as well as marine plants, the former forming the beds of coal at this period all over the world. At this time the whole of the middle continent of America was covered by a vast inland sea. Growth and decay of fresh water plants, in succession, followed for centuries, depositing Bituminous matter in the gradual reclaiming of the continent by depressions and upheavals, which, when confined between alternate stratas of earth and rock, and subjected to internal heat, became coal.

The dislocations that followed the upheaval of the Appalachian ranges confined large bodies of water, which, in escaping, carried away the loosened strata of coal formations, which accounts for the absence of coal in a large proportion of the South.

There are several varieties of coal, all formed by chemical action on wood and vegetable matter. When exposed to moisture and air, it is converted into a powder called mould, and this, when covered, confines the gases, and being acted upon by internal heat, becomes coal ; the longer the process the greater propor. tion of carbon in the residue. Thus :

Coking coal,	=C20,	H9,	O	considered the richest.
Splint, or Cannel Coal,	=C24,	H13,	O	
Wood, or Brown "	=C33,	H21,	O16	
Oak wood decayed in air,	=C36,	H22,	O22	
" " water,	=C33,	H27,	O24	

The quality of coal is based upon its amount of carbon and absence of hydrogen.

The varieties of coal are arranged into two groups—Bituminous and Anthracite. The latter is hard and compact; its specific

gravity varies from 1.3 to 1.75, and contains from 80 to 90 per cent of carbon. The Lehigh and Pittston coal, of Pennsylvania, are the best specimens of this coal in this country. In some varieties of anthracite, bitumen is present, and gradually passes into bituminous coal, which varies according to the amount of bitumen.

Mineral coal is produced by long continued decomposition of wood and wood coal, by which carbonic acid, water and carburetted hydrogen are separated. When the whole of the hydrogen is removed, in the form of carburetted hydrogen, the residue must be anthracite.

Mineral coal is widely distributed over the world. It is found in France, Spain, Portugal, Belgium, Germany, Austria, Sweden, Poland, Russia, India, China, Madagascar, Van Dieman's Land, Borneo, East India Islands, New Holland, Chili, and an excellent stratum of coal in New Zealand three feet thick.

The most extensive deposits known are in the United States, where there are four great areas. One commences on the north, in Pennsylvania and south-eastern Ohio, and sweeping south over Western Virginia and Eastern Kentucky and Tennessee, to the west of the Appalachians, it continues to Alabama near Tuscaloosa. It has been estimated to cover 63,000 square miles.

A second coal area (the Illinois) lies adjoining the Mississippi, and covers a large part of Illinois, the western part of Indiana, and a small north-west part of Kentucky. It is but little smaller than the preceding.

A third area occupies a portion of Missouri west of the Mississippi. A fourth area covers the central portion of Michigan. There is also a small coal region in Rhode Island.

It is calculated by the best authorities that the United States has one square mile of coal field to every 15 square miles; Great Britain, one to 30; Belgium, one to 22½, and France, one to every 200 square miles of surface.

Multiplying these areas by observed and assumed depths, the cubic measure, in tons of coal reserves, in the great coal fields of the world, are as follows:

		Tons.
Belgium, asserted at depth	60	36,000,000,000
France, " "	60	59,000,000,000
British Islands, average depth.......	35	142,500,000,000
Pennsylvania, " "	25	316,400,000,000
Appalachian, " "	25	1,337,500,000,000
Indiana, Illinois and W. Kentucky, average depth..................	25	1,277,000,000,000
Iowa, Missouri, Kansas, Nebraska, Indian Territory and Texas, depth.	10	739,000,000,600
All productive coal fields, N. America.	.. ....	4,000,000,000,000

Coal Fields of the British Islands.

It is contended with much seeming truth (says Brandt), that coals were in use by the ancient Britons.

According to Stowe, coal was first discovered at Newcastle-upon-Tyne in 1234, some say earlier and others in 1239. Sea coal was prohibited from being used in London and vicinity as prejudicial to health, and wood substituted by the smiths in 1273. Coal was first made an article of trade from Newcastle to London in 1831.

Notwithstanding the many complaints against its use, it was generally burned in London in 1400; but not in common use in England until 1625.

The following statement shows the quantity of coal consumed in London in the following years:

1650	373,300 tons.
1700	739,000 "
1750	1,190,000 "
1800	1,900,000 "
1810	2,306,000 "
1820	2,730,000 "
1830	3,706,000 "
1835	5,360,000 "
1840	6,152,000 "

The workable area of the coal fields of the British Islands embraces over 5,700,000 acres, yielding annually from 80 to 86 million tons of coal.

The total quantity mined from 1854 to 1863 inclusive, was 726,751,566 tons. This quantity in bulk would make a solid column 660 feet square at the base, and 37,800 feet high, and by weight equal to 482 million cords of wood. Its evaporative efficiency would equal 1200 million cords of wood, to produce which would require the clearing of 12 millions acres of the best timbered land.

The quantity lifted from the mines in 1863 was 86,292,215 tons, which, if placed on a ten acre lot (660 feet square), would make a column 4,580 feet high, and equal in weight to 58 million cords of wood. Its evaporative efficiency would equal 146 million cords, which to produce would require the clearing of 1½ million acres of land.

The following statement shows the number of tons of coal lifted from the British mines, and estimated value at the place of production:

	Tons mined.	Val. per ton at the mines.	Total value of coal mined.
Year of 1854	64,661,401	$1 21	$78,240,294
" 1855	61,453,079	1 26	77,988,212
" 1856	66,645,450	1 21	80,653,092
" 1857	65,394,707	1 06	79,127,591
" 1858	65,008,649	1 21	78,660,464
" 1859	71,979,765	1 24	87,095,514
" 1860	80,042,698	1 21	96,851,663
" 1861	83,635,214	1 21	101,198,606
" 1862	81,638,388	1 21	98,782,586
" 1863	86,292,215	1 15	99,573,053
Totals	726,751,566	$1 20	$878,171,075

The question of exhaustion of coal in the British Islands has been very much discussed of late years, and the subject of parliamentary inquiry. Upon the mere question of quantity they may be considered inexhaustable, but especial regard must be had to the quality and depth from which it must be taken. The expense of mining the inferior coal can only be borne by its conjunction with the superior quality. Inferior coal cannot be profitably raised from pits of from 1,100 to 1,400 feet in depth. It is computed by men in England of the highest respectability and talent, that at the present rate of consumption, the coal fields will be thoroughly exhausted of the lapse of from 200 to 300 years from this date. It is also demonstrated, that owing to the great depth which must be penetrated, the consequent increased temperature of the air will make it almost impossible for man to labor in those depths. In the Yorkshire coal fields the temperature in the main roads is from 50 deg. to 60 deg., and side roads 60 deg. to 65 deg., and at the workings 64 deg. to 72 deg. In the deep mines of the northern coal fields it is 66 deg. at the bottom of the shafts, and 70 deg. at the workings; and in the deepest pits the average range is from 78 deg. to 80 deg., and occasionally reaches to 89 deg. Great economy has been effected of late years in the English mines by saving and converting to coke, for locomotive engines and iron works, the pulverized coal formerly wasted at the rate of a million tons a year; and it has become so useful in this condition that large lumps are now crushed for coking to meet the increased demand.

The operation of mining is the same as in Pennsylvania, but more extensive and at greater depths. The points for sinking

shafts are indicated by test borings. The shafts are vertical, and from 10 to 15 feet in diameter. The first portion to the first strata of rock is walled to keep the earth from falling in, and the remainder (average 250 feet) is lined or cribbed with cast iron, to prevent the shaft being submerged with water from numerous springs met with in the progress of sinking. In the northern coal fields the shafts are rarely less than 150 feet deep, and many have the great depth of 1,800 feet, sunk at an expense in some cases of $240,000. When the seam intended to be worked is reached, broad passages, from 12 to 14 feet wide, are driven from the shaft in opposite directions, to the full depth of the seam, exposing the rock above. A gallery or drip-head for collecting the water is then excavated, usually inclosing the limits of the coal pit *won* by that shaft. From this gallery numerous others are driven at right angles of from 24 to 36 feet apart, and communicating with each other, thus entirely exposing the coal, and presenting the form of a regularly laid out village, with its avenues and alleys. In many of the most extensive mines two shafts are sunk 45 to 60 feet apart, and connected at the bottom, one called the downcast for admitting the pure air, and the upcast for the passage of the foul air from the mines. When single shafts are used they are divided by air-tight partitions, answering the same purpose, but affording less facilities for raising the coal. The air is set in motion and maintained through the mines by keeping a fire or furnace constantly burning at the foot of the upcast, producing ordinarily a velocity of from two to two and a half feet per second at the workings. It is estimated that the minimum quantity of fresh air required for each man is from 15 to 18 cubic feet per minute.

The Hetton Colliery has three shafts, two downcast, each 12 feet in diameter and 900 feet deep, and one upcast 14 feet in diameter and 1056 feet deep. Three furnaces are kept constantly burning at the foot of the upcast, introducing 168,850 cubic feet of fresh air into the mines per minute, at a cost of eight tons of coal per day. This body of air is divided into sixteen currents, each traversing a circuit of four and a-half miles, the longest circuit being nine miles, and producing a velocity, at the workings, of three to five feet per second. Other methods are now in use to facilitate the ventilation of mines, such as the introduction of drums, 22 feet in diameter, with radial compartments that revolve on the top of towers constructed over the downcast and upcast shafts; also substituting a high-pressure steam boiler for the fur-

nace, that expels the air with great force from the shaft, by heating the air with jets of steam.

The coal measures of England are generally between the old red sandstone at the bottom, and new red sandstone at the top; and the series of rocks met with in descending are beds of sandstone, shale, clay and coal, in repeated alternations to a great depth. The lowest coal seams generally rest on the mountain limestone, and seldom extend below this into the old red sandstone. The Pit coal is obtained from depths of from 600 to 1500 feet, the miner traversing two or three miles in subterranean passages to his work. The Ten-yard coal is peculiar to the South Staffordshire mines, where it is taken from a depth of from 900 to 1000 feet, and found beneath the lower new red sandstone. The following table will show the areas and valuable characteristics and extent of the coal seams of mines of the British Islands:

Table of the principal Coal-fields of the British Islands.

COAL FIELDS.	NAME OF DISTRICT.	WORKABLE DIMENSIONS. Area in acres.	Number of seams.	Est'ed total thickness in feet.	Thickest bed in ft.	Thickness of coal bearing measures, in feet.
Newcastle	Northumberland & Durham	500,000	18	80	7	......
Whitehaven & Ackerton	Cumberland, Westmoreland & W. Riding	80,000	7	....	8	2,000
Appleby (3 basins)	do	17,000	....	....	....	......
Sebergham (Cumb.)	do	....	1	3	3	......
Kirk by Lonsdale	do	2,500	4	17	9	......
Lancashire	Lancashire, Flintshire & North Staffordshire	380,000	75	150	10	6,000
Flintshire	do	120,000	5	39	9	200
Pottery, N. Staffordshire.	do	40,000	24	38	10	......
Cheadle, do	do	10,000	....	....	....	......
Great Yorkshire	Yorkshire, Nottinghamshire & Derbyshire	650,000	12	32	10	......
Darley & Shirley Moor	do	1,500	....	....	....	......
Colebrook Dale	Shropshire & Worcestershire	21,000	17	40	....	......
Shrewsbury	do	16,000	3	....	....	......
Brown Clee-hill	do	1,300	3	....	....	......
Titterstone, do	do	5,000	....	....	....	......
Lickey Hill	do	650	....	....	....	......
Bewdley	do	45,000	....	....	....	......
Dudley & Wolverhampton.	South Staffordshire	65,000	11	67	40	1,000
Nuneaton	Warwickshire & Leicestershire.	40,000	9	30	15	......
Ashby-de-la-Zouch	do	40,000	5	33	21	......
Bristol	Somersetshire & Gloucestershire	130,000	50	90	....	......
Forest of Dean	do	36,000	17	37	....	......
Newent, Gloucestershire	do	1,500	4	15	7	......
South Welsh	South Welsh	600,000	30	100	9	12,000
Three Basins	Scottish Coal Fields	1,000,000	84	200	13	6,000
Mid-Lothian	do	....	24	94	....	4,400
East-Lothian	do	....	60	180	13	6,000
Kilmarnock & Ayrshire	do	....	3	40	30	......
Fifeshire	do	....	....	....	21	......

Table of the principal Coal-fields—Continued.

COAL FIELDS.	NAME OF DISTRICT.	Workable Dimensions. Area in acres.	Number of seams.	Est'ed total thickness in feet.	Thickest bed in ft.	Thickness of coal bearing measures, in feet.
Dumfries	Scottish Coal Fields	45,000	10	55	6	......
Ulster	Irish Coal Fields	500,000	9	40	6	......
Connaught	do	200,000	....	....	....	......
Leinster	Kilkenny Coal Fields	150,000	8	23	....	......
Munster	do	1,000,000	....	....	....	......
	Total area	5,697,450				

The facilities for working the 10-yard coal is far different than obtaining coal from thin seams. The seams actually worked in England vary from 10 inches to 30 feet, and the average does not exceed 6½ feet. As the thickness of the seam diminishes the expense rapidly increases. But little disadvantage is experienced until the seam gets below four feet, when neither ponies nor asses can be used. The labor then must be performed in a stooping position, and by boys mostly. The following paper by Mr. Cossham gives much valuable information in regard to the extent, cost and method of working thin seams in England:

Extract of the proceedings of the "South Wales Institute of Engineers," at Swansea, September, 1861:

Mr. Cossham, after a few prefatory remarks, said that the paper which he was about to read was an eminently practical and important one. Probably more than one-half of the coal which nature had implanted in the bowels of the earth, existed in thin seams under two feet thick, and when they remembered that the annual drain upon the supply reached no less than 80,000,000 tons, they would at once see the necessity of doing all in their power to produce economy in the working—to develop their resources, and to utilize, as far as they possibly could, every portion of those resources. He was fully convinced in his own mind that fully 50 per cent. of coal was at present lost from one of three causes: First, being left under ground untouched; secondly, by being only partly raised, owing to unskilful and unscientific management; and thirdly, by being wasted in its use after being brought to the surface. It was upon the first of these propositions that his paper now treated. In the Newcastle district alone there were thin seams of coal, all under three feet thick, which, if properly and economically worked and used, would supply the present consumption for 400 years, so that there need be no fear of the consumption falling short. Probably the first important question which would be asked was, what thickness of coal could be worked at a profit? Of course the answer to that would depend in a great measure upon the quality of the coal; but, in his opinion, every seam of coal at

and over eighteen inches ought to be worked. He had the superintendence of a colliery at the present time, which produced between 2,000 and 3,000 tons per week, and every seam was under three feet thick. As to the best way of working thin seams of coal, he would say that the long wall system should be adopted, and all the coal must be worked out of thin seams if they were to be worked profitably. He would also recommend the adoption of gob-roads for air-ways instead of pillars; secondly, loading the trams at the face, and thus avoiding the shifting of coal. The gob-roads should be carried to the face every 15 or 20 yards. About eight cwts. should be placed on each tram, and each tram should weigh about three cwts.,—the roads to be 21-inch gauge. As to the cost of working thin seams, he should say that seams from two feet to two feet six inches thick should be worked at 4s. 3d. per ton for labor; materials 1s. per ton, and other items, making a total of 5s. 9d. per ton. Seams of from 18 inches to two feet thick ought to be worked at 4s. 6d. per ton labor, other items making a total of 5s. 10d. or 5s. 11d. per ton. Seams from 12 inches to 18 inches should be worked at 5s. per ton labor, other items making a total of 6s. 3d. or 6s. 4d. per ton. These would be exclusive of interest upon the capital employed. Mr. Cossham then remarked that the liability to danger and fatal accidents was very much lessened in working thin seams as compared with thick. The risk and danger of working coal above five feet is much greater than in seams below that thickness. He need only refer, in proof of what he now stated, to the working of the thick seams in the south of Staffordshire. He had lately visited that district, and was struck with the fearful risk and danger attending the working of coal there, and also with the terrible waste which is going on there. Mr. Cossham here said: "I do not hesitate to say that thousands of people have been transported for less crimes than are committed against God and humanity by the reckless, careless, destruction, and wasteful way in which that wondrous field is now working, involving, as it does, the destruction of over 300 lives annually, and over 60 per cent. of coal." In South Staffordshire it was found that one life was sacrificed for every 83,000 tons of coal raised, whilst in Somersetshire the loss was only one in 110,000 or 120,000, or in some instances 150,000 tons. Mr. Cossham concluded by remarking that it must be regarded as a national loss that thin seams were not more extensively and profitably worked.

The following were the selling prices of English coals in New York market in October 1861 and 1864, per ton, delivered:

Cannel coal, in 1861	$6 50	In 1864	$25 00
Liverpool coal, in 1861	8 00	" 1864	26 00
English gas coal, in 1861	6 10	" 1864	25 00
Newcastle coal, in 1861	5 75	" 1864	25 00
Cannel coal, Boston m'ket, in 1861,	9 25	" 1864	28 25

Analysis and Economic Value of British Coals, by Sir H. De La Beche and Dr. L. Playfair.

		Specific gravity.	Carbon.	Hydrogen.	Nitrogen.	Sulphur.	Oxygen,	Ash.	Per cent coke.	Evaporative power.	Remarks.
Welsh coals.	1	1.375	91.44	3.46	0.21	0.79	2.58	1.52	92.90	9.46	Anthracite.
	2	1.275	89.78	5.15	2.16	1.02	0.39	1.50	77.50	10.21	Elbro Vale.
	3	1.304	88.66	4.63	1.43	0.33	1.03	3.96	88.10	9.94	Binea coal.
	4	1.326	88.26	4.66	1.45	1.77	0.60	3.26	84.30	10.14	Duffryn.
	5	1.358	85.52	3.72	trace	0.12	4.55	6.09	85.00	6.36	Pentrefelin.
	6	1.300	84.87	3.84	0.41	0.45	7.19	3.24	85.50	9.35	Graigola.
	7	1.320	80.70	5.66	1.35	2.39	4.38	5.52	64.80	7.47	Pouty Pool.
	8	1.340	75.15	4.93	1.07	2.85	5.04	10.96	62.50	8.84	¾ Rock Vein.
	9	1.290	78.84	5.14	1.47	2.34	8.29	8.92	56.00	8.00	Coleshill.
Scotch.	10	1.277	74.55	5.14	0.10	0.33	15.51	4.37	49.80	7.08	Dalkeith, Jewel seam.
	11	1.316	76.94	5.20	trace	0.38	4.37	3.10	53.50	7.71	" Coronation seam.
	12	1.200	76.09	5.22	1.41	1.53	5.05	10.70	58.45	8.46	Wallsend Elgin.
	13	1.250	79.58	5.50	1.13	1.46	8.33	4.00	52.03	7.56	Fordel Splint.
	14	1.290	79.85	5.28	1.35	1.42	8.58	3.52	56.60	7.40	Grangemouth.
Eng'h	15	1.250	81.70	6.17	1.84	2.85	4.37	3.07	59.20	7.30	Broomhill. [Dean.
"	16	1.283	73.52	5.69	2.04	2.27	6.48	10.00	57.80	8.52	Parkend, Sydney, Forest of
Irish	17	1.590	80.03	2.30	0.23	6.76	in ash	10.80	90.10	9.85	Slievardagh.

The Geological Society of London ascribe the differences in the different varieties of coal to the original difference in the plants from which they are derived. The following are the recognized varieties of English bituminous coals : Caking, or Pitching coal burns with yellow flame, separates into small pieces when heated, and its color of a greyish black. Cherry coal burns with a clear yellow flame, but does not soften as the Caking coal. Splint coal is harder than Cherry coal, and taken from the Glasgow mines. Cannel, or Candle coal burns without melting, and often substituted for candles ; it is hard and compact, and often manufactured into ornaments. Brown, or Lignite coal retains the resemblance of the original wood, and burns with an empyreumatic odor. Jet coal resembles Cannel, but harder, and admits of a fine polish, and often set in jewelry. The Newcastle coal consists of several varieties—the rich Caking, Cannel or Parrot, Splint and Slate coal.

Coal Exported to the United States.

The exportation of coal from England greatly increased after the repeal of the duty in 1845. The total quantity of coal exported from the British mines, in 1849, amounted to $5,000,000. It is used as ballast to ships trading with this and other countries, which enables a brisk competition with domestic coals. (For amount of coal exported, see table, Bituminous coal.)

NOVA SCOTIA MINES.

Beyond the limits of the United States, on the northeast, commences a coal area, that of Nova Scotia and New Brunswick, which covers 10,000 square miles. There is also another at Cape Breton. In 1863 over 400,000 tons of coal were raised from Cape Breton and Nova Scotia mines, giving a value of nearly one million dollars at the pits' mouth—$2.50 per ton.

The bituminous coal mines of Nova Scotia were opened nearly 40 years ago. The quantity of coal mined from 1827 to 1857 was doubled from 1858 to 1863 inclusive. The exports of coal shipped mainly from Cape Breton in 1863 exceeded that of 1862 by 37,000 tons. The mines of that island fell short 10,000 tons, and the Albion mines, at Pictou, 4,429 tons; but the falling off of these mines was more than made up from other mines, showing an aggregate increase of over 24,000 tons. New and extensive mines have been lately opened in Cumberland county, at an expense of $19,-600, that yielded in 1863 over 55,000 tons.

The Albion and Sydney mines were the first opened in Nova Scotia. These two mines have yielded, since 1827, over 6,000,000 tons. The Sydney mines yielded and exported 104,342 tons in 1863, and the Albion mines 193,320 tons, with the labor of 1193 men and boys, 165 horses, and 940 horse-power of engines. The Bridgeport mines were opened in 1830, and became exhausted in 1850. Little Bras d'Or mines were opened in 1833, and were exhausted in 1853.

The following shows the number of mines and quantity of coal taken from each, taken from the Halifax *Sun* :

Frazer Mines, Pictou County, lies 6½ miles from navigable water, and have not been worked for else than local consumption. They were first opened with a view of obtaining coal oil, but they were abandoned, and the proprietor is now engaged in inaugurating a company to develop the mines thoroughly.

The Little Bras d'Or Collieries, owned by Collins, Goutro & Collins & C. J. Campbell, have more or less fallen short in 1863. But with increased energy and a liberal expenditure they may be rendered paying investments, when the seams are not exhausted. Gross amount of coal raised, 4,170 tons.

Roach & McGinnis have opened a mine near North Sydney, but as yet with no satisfactory results.

Union Mines, Bridgeport, opened in 1858. The coal has a fair market reputation ; but the success of this colliery is seriously marred by the want of a suitable shipping place. Quantity past year, 4,197 tons.

Little Glace Bay Colliery, the property of an American Company, produces coal of a very superior quality, both for gas and domestic purposes. It is called the Hub-vein coal. These enterprising capitalists

have constructed an artificial harbor with great skill and expense, and purpose to expend in the present year $134,708. The amount of coal raised and sold during the past year was 26,728 tons.

Big Glace Bay Colliery, belongs to J. & A. Campbell. It was opened in January, 1863—the sum expended, $2,900—amount of coal raised, 508 tons. The drawback to the Union Mines, viz., a want of proper shipping places, applies to this colliery also.

Schooner Pond Colliery, to the N. W. of the North head of Cow Bay, is the property of Messrs. Ross, Kaye & Symonds. Formerly it was worked by private individuals for their own use. Preparations are now being made to put it in paying order. Already $3,572 have been laid out, and 1,378 tons of coal raised and shipped.

Block House Colliery, Cow Bay, belongs to Mr. Belloni, of New York. From the opening of this mine, under Mr. Marshall Bourinot, Belloni supplied the funds, and has now personal management of the works. This gentleman has been at very great expense in making every necessary improvement. He is now having built a wharf, extending into the harbor 1,000 feet, 75 feet wide, and reaching a depth of water of five fathoms. In 1863, $37,000 was expended on various improvements, and amount of coal raised 15,690 tons.

Gowrie Colliery, Cow Bay, Hon. T. D. Archibald & Co., is a very valuable and well conducted property. During the past two years $91,000 have been laid out, one of the items of expense being a wharf extending into the bay 770 feet, and a breakwater 100 feet by 50 feet. The expense for 1863 was $63,260, and total amount of coal raised and shipped 15,069 tons, of very superior quality.

Mire Bay, Young, Tracy & Slattery. Want of shipping place prevents this from becoming a profitable investment, for the coal is good. Amount raised and shipped, 549 tons.

Kelly Cove, or New Campbell Town Colliery, owned by C. J. Campbell, promises to be a valuable property. Mr. C. is prosecuting the work with great energy, and has laid out $34,000 last year. Amount of coal raised and shipped, 4,000 tons.

Richmond Colliery, situated 2½ miles from mouth of Little River. There has been altogether expended $24,499 upon the mine, and a large quantity of coal, some good and some containing much sulphurid of iron, but only 1,100 tons have been shipped.

Sea Coal Bay Colliery, Richmond Co., owned by Mr. John Campbell, has made very little progress as a remunerative speculation, although more than $12,000 have already been expended on it. 219 tons is all that has been shipped in 1863.

The whole amount of coal raised and sold from Nova Scotia, from 1827 to 1857, when the monopoly of the General Mining Association ceased, was 1,841,538 tons. The amount raised and sold in 1857, was 101,082 chaldrons. Since that time the amount has steadily increased, being in—

1858	239,618 tons.
1859	267,496 "
1860	304,129 "
1861	334,545 "
1862	398,631 "
1863	424,425 "
In 1863 there was sold in Nova Scotia	76,061 tons.
" " other Provinces	65,773 "
" " the United States	286,790 "

Two-thirds of the yield of the mines of Nova Scotia are taken to the United States.

The freight charges on coal, sea-borne, from the Sydney mines to Boston, in 1861, were $1.50 per ton.

The following were the selling prices of coal from the mines of Nova Scotia, in October, 1861 and 1864, at the Boston market :

Sydney coal in 1861	$4 25	in 1864	$11 50
Pictou "	4 25	"	12 50

Making an average increase of 1864, over the prices of 1861, equal 182 per cent.

Coal Fields of the United States.

Distribution, Quality, etc.

The railroad companies in this country, of late, are turning their attention to the use of coal instead of wood, on account of its cheapness and convenient distribution throughout the United States. Ohio contains more coal than all of Great Britain.

The following statement shows the area of coal reserves in each State :

State.	Square miles.	Square acres.
Georgia	150	96,000
Maryland	550	352,000
Alabama	3,400	2,136,000
Tennessee	4,300	2,752,000
Michigan	5,000	3,200,000
Missouri	6,000	3,840,000
Indiana	7,700	4,928,000
Ohio	11,900	7,616,000
Kentucky	13,500	8,640,000
Pennsylvania	15,437	9,879,600
Virginia	21,195	13,564,800
Illinois	44,000	28,160,000
Totals	133,132	85,204,480

The following statement (from the works of Overman) gives the character and evaporative power of the different American coals :

NAME OF COAL.	STATE WHERE FOUND.	Percentage of carbon.	Steam of 212° evaporated per lb.	Quantity of heat by volume.	Percentage of coke by weight.
Anthracite.					
Beaver Meadow	Pennsylvania	88.9	10.4	94	....
Forest Improvement	do	90.7	10.8	94	....
Lehigh	do	89.1	9.6	94	....
Lackawanna	do	87.1	10.7	94	....
Coke.					
Mid-Lothian	Virginia	....	10.3	92	.66
Cumberland	Maryland	....	10.3	92	.75

NAME OF COAL.	STATE WHERE FOUND.	Percentage of carbon.	Steam of 212° evaporated per lb.	Quantity of heat by volume.	Percentage of coke by weight.
Bituminous.					
Maryland	Maryland	73.5	11.2	85	......
Cumberland	do	74.3	11.0	85	......
Blossburg	Pennsylvania	73.4	10.9	85	.83
Karthans	do	73.8	9.8	85	.88
Cambria county	do	69.4	10.2	85	......
Clover Hill	Virginia	56.8	8.5	85	.68
Tippecanoe	do	64.6	8.5	85	......
Pittsburg	Pennsylvania	55.0	8.9	85	.68
Missouri	Missouri	......	......	......	.57
Barclay mines	Pennsylvania	84	......	......	......

Anthracite coal is used for locomotive fuel in its natural state, chiefly upon roads on the eastern slope of the Alleganies. The bituminous coal, lying between the summits of the Alleganies and Rocky Mountains, contains in its natural state so much pitchy matter, as to render it unfit for locomotive purposes; but when the bitumen is burnt off, no fuel equals it.

The following statement (from Vose) shows the relative properties of good coke, coal and wood:

	Weight pr cubic ft. lbs.	Degrees of heat generated.	Percentage of carbon in fuel.	Economic bulk or cubic feet to stow one ton.	Economic or stowage weight pr cubic foot.	Cubic ft of air to evaporate 1 lb. of water.	Equivalent economic bulk to evap'e same weight of water.	Weight of water evaporated per lb. of fuel in ordinary practice.	Relative value as fuel disregarding actual cost.
Coke	63	4,300	95	80	28	22.4	13	8½	100
Coal	80	4,000	88	44	51	32.0	10	6	71
Wood	30	2,800	20	107	21	16.0	60	2½	29

This statement shows that, by bulk, 13 of coke are equal to 60 of wood; that one pound of coke evaporates 8½ pounds of water, while one pound of wood evaporates only 2½ pounds of water.

A cord of wood contains 100 cubic feet solid, or 128 feet as piled, and will weigh 3000 pounds. The relative evaporative efficiency of a cord of wood and a ton of coke, (2240 lbs.) $\times$ 8½ =19,040, and wood, 3000 $\times$ 2½=7500. Hence, if a cord of wood, cut and ready for burning, costs $3 per cord, coke should cost, per ton, 7\frac{62}{100}$.

Relative Value of Wood and Coal for Locomotive Purposes.

The following are the results of experience, as to the relative value of wood and coal. By experiments with the engines of the Baltimore and Ohio Railroad, it was found that 2.55 lbs. pine wood was equal to one pound Cumberland coal. On the Reading Railroad, three pounds (Pennsylvania) pine wood was equal to one pound anthracite coal.

The following statement shows the values of wood and coke for locomotive use, based upon their relative evaporative efficiency, from the proportion—as 7,500 (the evaporative efficiency of wood) is to 19,040 (evaporative efficiency of coke), so is the price of a cord of wood to the price that may be paid for a ton of coke:

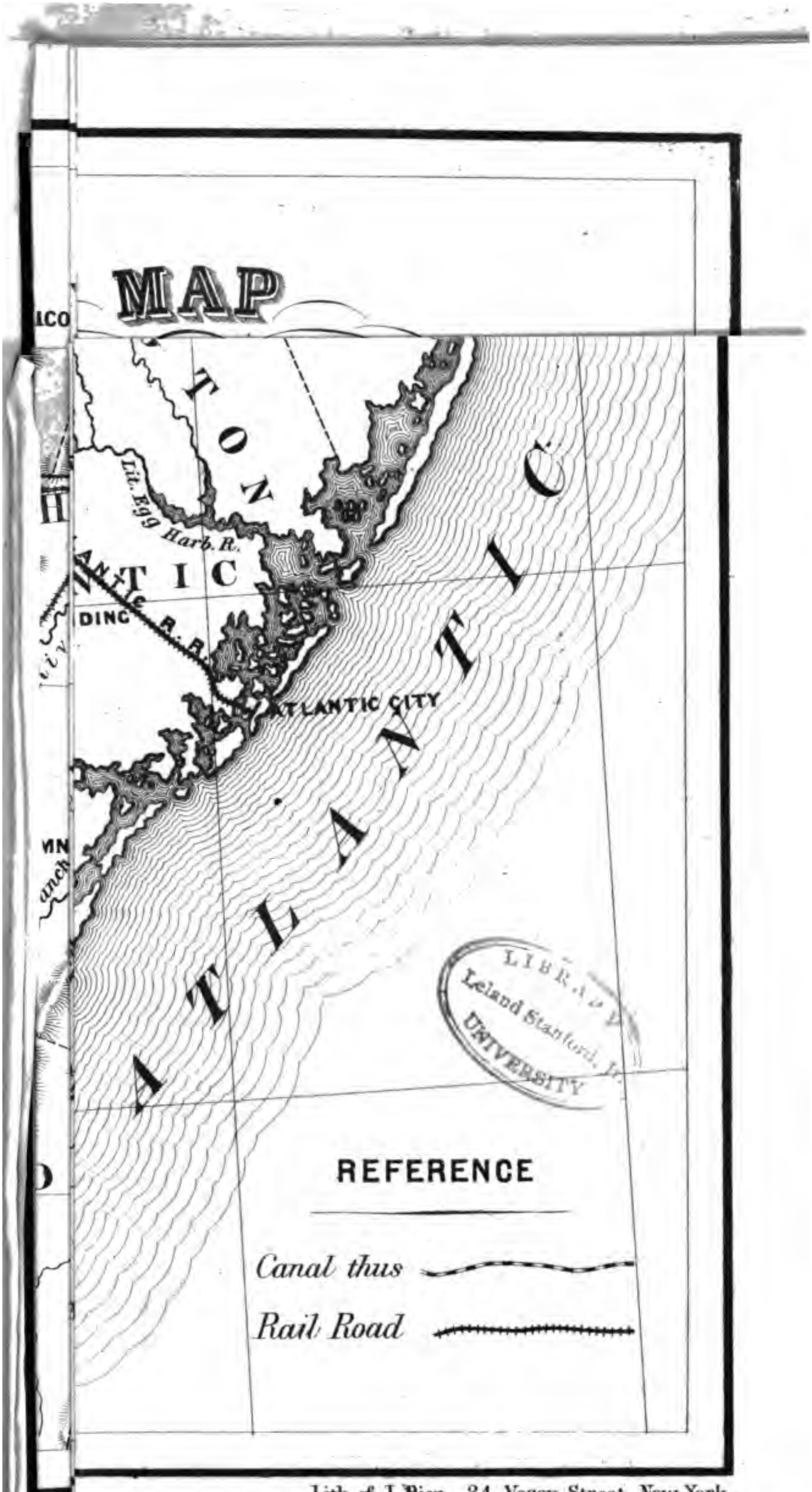
Evaporative power of wood.	Evaporative power of coke.	Cost per cord of wood ready for burning.	Price that may be paid pr ton for coke.
As 7,500	Is to 19,040	So is $2 00	To $5 08
7,500	19,040	2 25	5 71
7,500	19,040	2 50	6 35
7,500	19,040	2 75	6 98
7,500	19,040	3 00	7 62
7,500	19,040	3 25	8 25
7,500	19,040	3 50	8 77
7,500	19,040	3 75	9 52
7,500	19,040	4 00	10 16
7,500	19,040	4 25	10 79
7,500	19,040	4 50	11 43
7,500	19,040	4 75	12 06
7,500	19,040	5 00	12 70

Coke is bituminous coal deprived of its bitumen by a slow process of baking the raw material in ovens so regulated with air vents as to char and not burn the coal, similar to the method of making charcoal from wood.

It is estimated to cost from 25 to 30 cents to convert a ton of coal to coke, the process reducing the weight 25 per cent. Hence, if a ton of coal cost, at the mines, $1.50, and 25 per cent for waste, a ton of coke would be $2.17; and, from the foregoing rule, wood should not exceed $0.85 per cord at the place of production, to be as economical for locomotive purposes.

Pure coke is solid carbon, and superior to all kinds of fuel for generating heat, as the power of fuel depends upon its amount of carbon. It has been found that when the Pittsburg coal has been properly coked for 48 hours, it gives 75 per cent by weight and 125 per cent by bulk—fine clean coke.

From tables of specific gravity, the average weight per cubic



Lith. of J Bien. 24 Vesey Street, New York.

foot of wood is 30 pounds; bituminous coal, 60 to 80; anthracite, 85 to 95; cannel, 75 to 80, and coke, 75 to 80 pounds.

Coke is most skilfully prepared in England, where it is exclusively used on railroads. The North-Western railroad company constructed 18 ovens, arranged in pairs, with a chimney for discharging the gases 115 feet high. The ovens are 11 by 12 feet inside, of an eliptical form, each communicating with the flue and dampers to regulate the draft. It takes, generally, 50 hours for the process. The best coke will sink in water, being from one half to three-quarters of a pound heavier.

Productive Anthracite Coal Fields of Pennsylvania.

The productive anthracite coal fields of Pennsylvania embrace an aggregate area of 304,720 square acres, yelding annually from seven to nine million tons of coal=one-ninth the quantity mined in the British mines.

The total quantity mined and sent to market, from 1820 to 1863 inclusive, was 114,789,535 tons. This quantity, in bulk, would make a solid column 660 feet square at the base and 6000 feet high, and by weight equal 76½ million cords of wood. Its evaporative efficiency would equal 191⅓ million cords of wood, which, to produce, would require the clearing of two millions acres of timbered land.

The quantity mined and sent to market in 1863 was 9,420,135 tons, which, if placed on a ten acre lot (660 feet square), would cover it 500 feet deep. Its weight would equal 6⅓ million cords of wood. Its evaporative efficiency is equal to 16 million cords of wood, which, to produce, would require the clearing of 160,000 acres of timbered land.

The coal measures in Pennsylvania present the best known evidences of upheaval of mountain ranges, and the birth of the Appalachian ranges have been traced to this State. The geographical location of the anthracite coal fields is between the Blue Ridge and Susquehanna River.

The coal north of the Susquehanna was not affected by the force of receding waters from the confined inland sea of the Carboniferous age; but being subjected to external chemical influences, changed bituminous to anthracite coal by freeing it of hydrogen. The disturbance to the western part of the State of Pennsylvania was slight, consequently no exposure, which left but

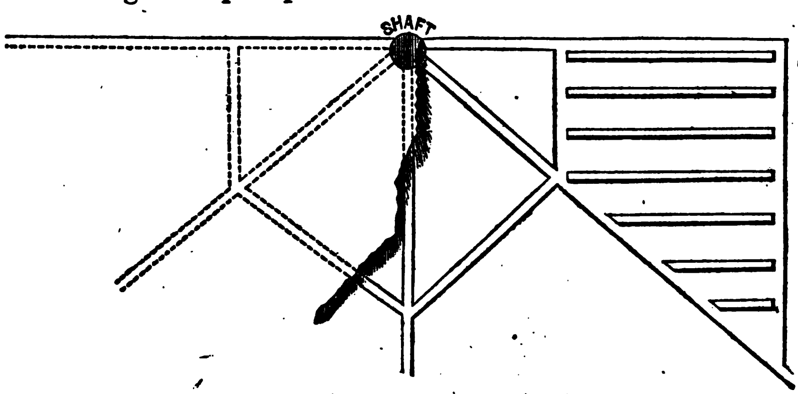
bituminous coal. The Scranton coal is believed to have been deposited there by the receding waters, as above the coal lie clay, micaceous sandstone and slate, and below it, shale, conglomerate sandstone and old Devonian deposits, which, according to Prof. Rogers, extend 40,000 feet below the surface.

The coal measures along the Lackawanna, from its source to its junction with the Susquehanna, lie in careless profusion; but no coal is found on the Susquehanna from this point to its source at Otsego and other small lakes in the State of New York. From this fact, Geologists have established the theory that the great basin between the Blue Ridge and the lower portion of the Susquehanna and Lackawanna Rivers was once one vast lake, into which the waters of the Chemung, Chenango, Delaware and Susquehanna Rivers emptied. These rivers, in time, forced passages to the Atlantic, leaving prolongations and exposing the coal and transferring it from inaccessible to accessible places for mining.

The Operation and Cost of Mining.

The operation of mining is generally the same where there is no direct access to the outcrop. Shafts are sunk sometimes 200 feet, over which a structure is built called a "coal cracker." This building contains the screens, coal-breaker and shutes, through and over which the coal is passed down an inclined plane into large bins, and from these placed into cars for market.

After sinking the shaft to the coal, subterranean chambers are excavated in every direction, called *drifts*. Partitions and columns are left to sustain the roofing until the mine is worked out, when these are gradually removed. The following sketch will show the general plan pursued:



The shaded portion shows the coal removed. This is detached by blasting, then partially broken and placed into trucks of from two to three tons burthen, and drawn by mules on railroads to the foot of the shaft. They are then hoisted by steam (the same that turns the coal-breaker) to the top of the coal-cracker, and dumped into a shute, along which men are stationed to break the large lumps before going on the breaker, which still reduces it to smaller pieces between rollers. After leaving the breaker it passes into another shute, into and down revolving screens which separate the coal into egg, stove, chestnut and pea sizes; each dropped into separate shutes and conveyed down inclined planes to bins at the end of each shute. The slate is separated from the coal by boys as it passes down the shutes.

Cost of Mining.

For each load the miner gets from 70 to 75 cents. In ordinary times the coal costs from \$1 to \$$1\frac{25}{100}$ placed into the cars ready to be moved to market. The most favorable location of coal for mining is the Hampshire tract, near Cumberland, Md., where it is taken from the sides of a hill, and delivered direct from the shute into the cars ready for market, the whole cost not exceeding 75 cents per ton in 1863, including all expenses connected with the same. The Barclay Coal Co. expressed themselves, in 1860, satisfied with the profits if they received \$1.75 per ton for their coal at Towanda, on the North Branch canal, 38 miles from Elmira. This would leave the cost of coal, including profits, at the mines (after deducting 23 cents per ton for transportation by rail 16½ miles from the mines to Towanda), \$1.52. Deducting interest on capital invested, with odinary profits (50 cents per ton), and it leaves the actual cost of mining and placing same into the cars for market, at \$1.02 per ton. The average cost of mining, with profits, in England, is \$1.20.

The following statement shows the quantity of anthracite coal mined, and number of tons sent to market over the following lines, from 1820 to 1863 inclusive :

Lehigh canal	21,563,506	tons.
Schuylkill canal	22,036,125	"
Union canal	1,399,472	"
Delaware and Hudson canal	11,281,690	"
North Branch canal	7,462,296	"
Total by canals	63,743,089	"
Philadelphia and Reading railroad	28,846,670	"
Lykens's Valley railroad	1,263,762	"
Dauphin and Susquehanna railroad	182,625	"
Lehigh Valley railroad	2,329,050	"
Shamokin railroad	1,697,598	"

Trevorton railroad	804,321	tons.
McCauley's Mount railroad	61,981	"
Pennsylvania Coal Co's railroad	7,429,897	"
Delaware and Lackawanna	7,665,238	"
Lehigh and Susquehanna	765,304	"
Total railroads and canals	114,785,535	"

The anthracite coal fields of Pennsylvania are divided into three great districts, viz : The 1st, Southern, or Schuylkill district, embracing the Lehigh and Lykens's Valley coal; the 2d, Middle district, embracing the Beaver Meadow, Shamokin and Trevorton coal ; the 3d, Northern, or Wyoming and Lackawanna, embracing the Scranton, Pittston and Lackawanna coal.

The following statement shows the progress of the Coal Trade, the quantity mined and sent to market from each district, each year, from 1820 *to* 1863 *inclusive:*

YEAR.	Schuylkill District.	Middle District.	Wyoming District.	Total.
1820	....	365	....	365
1821	....	1,073	....	1,073
1822	1,480	2,240	....	3,720
1823	1,128	5,823	....	6,951
1824	1,567	9,541	....	11,108
1825	6,500	28,393	....	34,893
1826	16,767	31,280	....	48,047
1827	31,360	32,074	....	63,434
1828	47,284	30,232	....	77,516
1829	79,973	25,110	7,000	112,083
1830	89,984	41,750	43,000	174,734
1831	81,854	40,966	54,000	176,820
1832	209,271	70,000	84,600	363,871
1833	252,971	123,000	111,777	487,748
1834	226,692	106,244	43,700	376,636
1835	339,508	131,250	90,000	560,758
1836	432,045	148,211	103,861	684,117
1837	523,152	223,902	115,387	879,444
1838	433,875	213,615	78,207	738,697
1839	442,608	221,025	122,300	818,402
1840	425,291	225,318	148,470	864,384
1841	585,542	143,037	192,270	959,973
1842	588,850	272,546	252,599	1,108,418
1843	735,312	267,793	285,605	1,263,598
1844	955,284	377,002	365,911	1,630,850
1845	1,262,197	429,453	451,836	2,013,013
1846	1,429,085	517,116	518,389	2,344,005
1847	1,867,772	633,507	583,067	2,882,309
1848	1,890,106	670,321	685,196	3,089,238
1849	1,864,206	781,656	732,910	3,217,641
1850	1,955,257	690,456	827,823	3,321,136
1851	2,565,426	964,224	1,156,167	4,329,530
1852	2,770,291	1,072,136	1,284,500	4,899,975
1853	2,913,454	1,054,309	1,475,732	5,097,144
1854	3,387,897	1,207,186	1,603,478	5,831,834
1855	3,782,594	1,275,050	1,771,511	6,486,097
1856	3,768,987	1,186,230	1,972,581	6,751,542
1857	3,393,455	900,314	1,952,603	6,431,378
1858	3,212,879	909,000	2,186,094	6,524,838
1859	3,598,501	1,050,659	2,731,236	7,517,516
1860	3,815,822	1,091,032	2,856,896	8,059,017
1861	3,114,254	994,705	2,918,458	7,487,672
1862	3,549,844	396,227	3,130,887	7,640,905
1863	4,151,882	699,558	3,766,374	9,420,135
Totals	60,889,181	19,295,929	34,604,425	114,789,535

From the foregoing statement the average annual rate of increase of the consumption of coal equals 15 per cent from 1830 to 1856, and $4\frac{1}{2}$ per cent from 1856 to 1862, and from 1862 to 1863 inclusive, 25 per cent.

The following statement of the coal tonnage of the six competing lines, from 1856 (when the Lehigh Valley and South Division of the Delaware and Lackawanna railroads were opened) to 1863, both inclusive, shows the quantity of anthracite coal moved on each line to market, and the total from each district.

The Pennsylvania Coal Company began to forward coal about the middle of December last, by rail over the Erie railroad to the Hudson River, making from that period seven independent Trunk lines from the mining region to market, on the Delaware, the Hudson and further east.

YEARS.	Schuylkill canal.	Philadelphia and Reading Railroad.	Total *via* Schuylkill Valley.	Lehigh canal.	Lehigh Valley Railroad.	Total *via* Lehigh Valley.	Delaware and Hudson canal.	Delaware, Lackawanna and Western Railroad, South Division.	Total from Lackawanna Valley.	Total tons moved on six lines.	Proportion of grand total by the two Schuylkill lines.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
1856	1,169,453	2,088,903	3,258,356	1,186,230	165,740	1,351,970	1,112,150	121,113	1,233,263	5,843,589	55 per ct.
1857	1,275,988	1,709,692	2,985,680	900,314	418,236	1,318,750	1,024,550	295,953	1,320,503	5,624,933	53 "
1858	1,323,804	1,542,646	2,866,450	908,800	471,930	1,380,730	977,929	538,247	1,516,176	5,763,356	49 "
1859	1,371,753	1,633,150	3,004,903	1,050,592	577,652	1,628,244	1,279,849	632,080	1,911,929	6,545,076	46 "
1860	1,356,688	1,878,156	3,234,844	1,001,032	730,642	1,821,674	1,201,091	827,954	2,029,045	7,085,563	45 "
1861	1,183,570	1,460,832	2,644,402	994,705	743,672	1,738,377	1,356,301	833,497	2,189,798	6,572,577	40 "
1862	980,727	2,080,815	3,061,542	396,227	882,574	1,278,801	1,238,157	1,105,483	2,343,640	6,683,983	46 "
1863	854,556	2,849,408	3,703,964	699,558	1,195,555	1,895,113	1,490,105	1,223,166	2,713,271	8,312,348	45 "

Of the 8,312,348 tons carried by the six lines, a railroad and canal from each region, the percentage is divided as follows :

Carried by the two Schuylkill lines		45	per cent.
"	" Lehigh lines	22¼	"
"	" Lackawanna lines	32¾	"

With the development in progress in the Mohanoy Coal Basin, and with the projected direct connection from the head of the Schuylkill Valley to the South end of the Wyoming Coal Basin completed, the two Schuylkill lines will unquestionably carry 50 per cent of the anthracite supply to the great seaboard market.

Description of each Coal Basin, and Routes from each to Market; also the Actual Cost of Coal over each Route.

1st. Southern or Schuylkill Basin.

This basin extends from the Lehigh river to within 20 miles of the Susquehanna, 50 miles in length and maximum width 5 miles. The total length of railroads within the limits of the basin is 170 miles. The following statement embraces the workable area :

	Acres.
East of Tamaqua, partly covered by the lands of the Lehigh Co.	12,240
Tamaqua to Pottsville	25,500
North Fork Lykens's Valley Prong	12,000
Pottsville west to forks of Basin	38,300
South Fork Dauphin Prong	10,000
North Mine Hill range	6,000
Total area Schuylkill Basin, 1863	104,040

The total quantity of coal mined and sent to market from 1820 to 1863 inclusive =60,889,181 tons, and during the year of 1863, 4,151,882 tons.

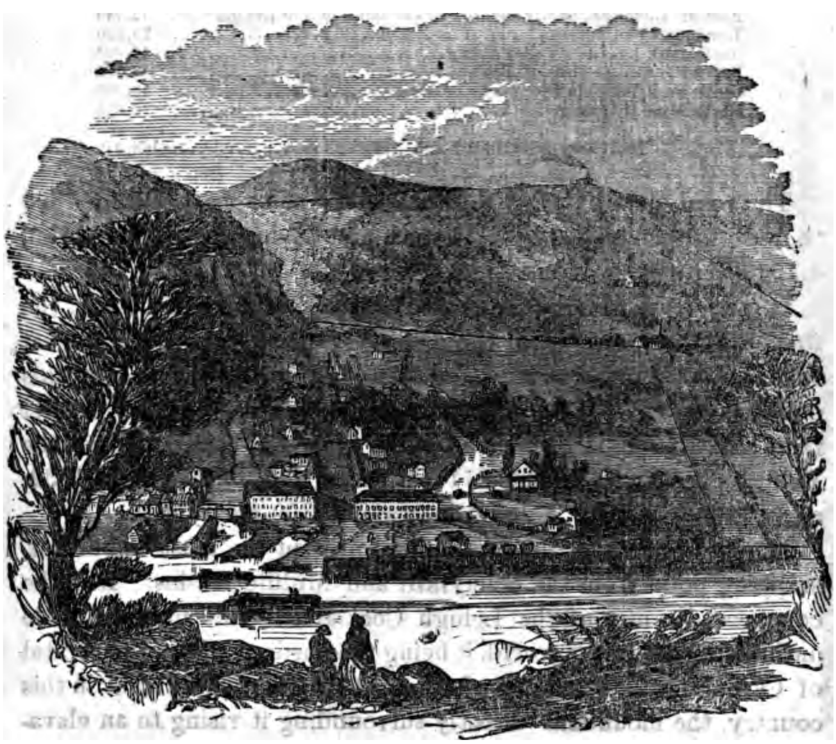
It was from this basin, in the vicinity of Mauch Chunk, the first coal was mined in the United States, in 1808; and at Mauch Chunk was constructed the first inclined plane in this country, in 1827. But 357,000 tons of coal was sent to market from 1820 to 1831 inclusive; when upon the completion of the Lehigh canal in 1831, 209,271 tons was sent to market in 1832, and 252,900 in 1833, a direct increase of 300 per cent.

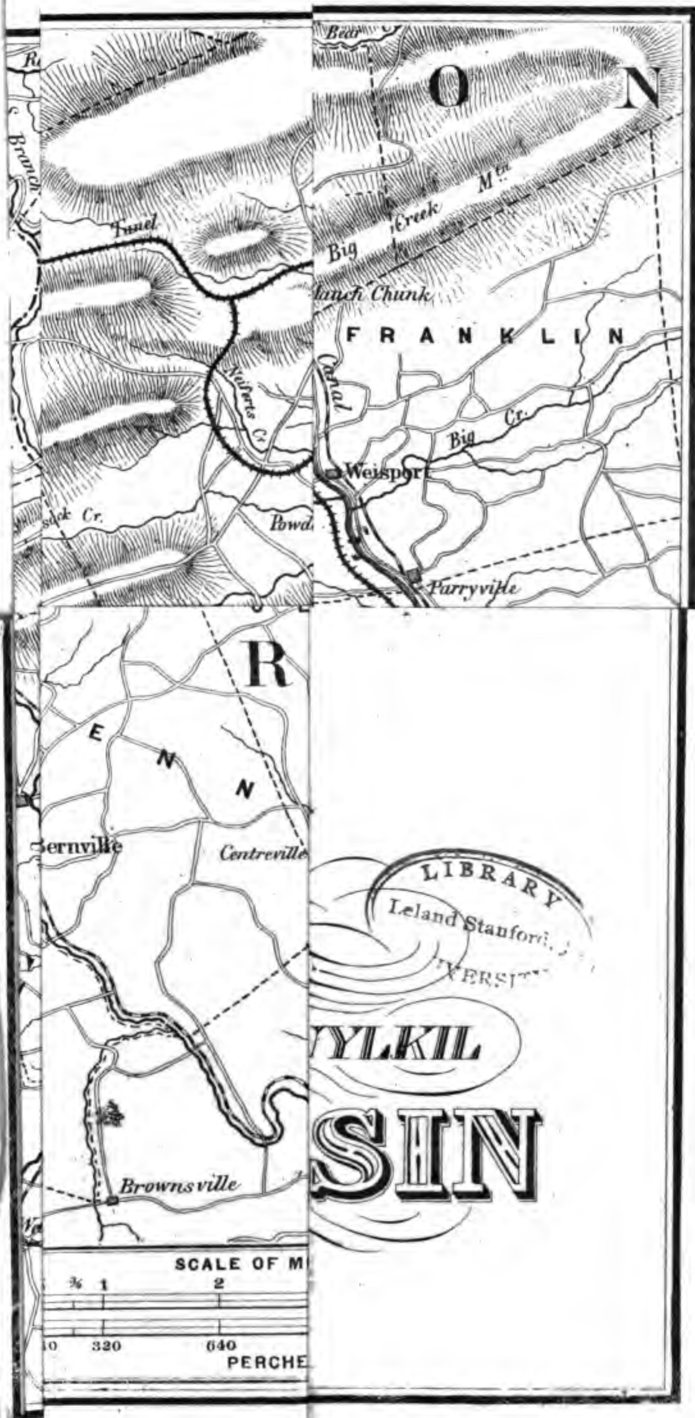
Mauch Chunk was the first, and at present the most important, shipping point from the Schuylkill and Middle Basins. It is the commercial center of the Lehigh Coal Basin—the most valuable anthracite coal in the world, it being the hardest. It is the capital of Carbon county, and one of the most picturesque villages in this country, the mountains directly surrounding it rising to an eleva-

tion of over 1000 feet, resembling the wild scenery of Switzer land. Part of the town is on an elevated plateau 200 feet above the Lehigh river, from which point numerous inclined planes can be seen, with trains of coal cars traversing the slopes of mountains by gravity and stationary power.

The cars used upon the inclined planes are about one-third the size of ordinary railroad cars. In ascending, a safety car is attached, from which the engineer at the top of the plane is signaled. The road leading from Mauch Chunk to the mines at Summit Hill, the cars are drawn up an inclined plane to an elevation of 700 feet above the river, in a distance of 2330 feet, and then descends, by gravity alone, 9 miles to the foot of another plane, up which the cars are again drawn by stationary power to the very summit of Mount Pisgah, about 10 miles from the village. From this point the road is carried in a zig-zag line (the force of gravity in descending overcoming the ascending grades) to different points in the mines. The coal measures in these mines are of greater thickness than any other part of the State, and mined mostly from the surface.

SKETCH OF THE INCLINED PLANES TO MOUNT PISGAH.




O N
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640
PERCHE

Mauch Chunk has a direct water communication with New York city (via the Lehigh canal, 46 miles, and the Morris canal, 102), 148 miles; with Philadelphia (via the Lehigh canal, 46 miles; Penn. Delaware Division canal, 60 miles, and Delaware river, 17 miles), 123 miles; with Havre de Grace (via the last route, 123; Delaware river, 47; Ches. and Del. canal, 13½; Ches. Bay, 24), 207½ miles; with Baltimore (via last route), 248 miles. It has also direct railroad communication with New York, 121 miles; Philadelphia, 89 miles; Havre de Grace, 153 miles, and Baltimore, 180 miles. (For distances from the several mines, in detail, see cost of coal.)

Besides Mauch Chunk there are the important shipping points —Tamaqua, Port Carbon, Pottsville, Pine Grove, Millersburg and Dauphin.

Tamaqua has direct railroad communication with Buffalo, 327 miles; Philadelphia, 96 miles. Tamaqua is 20 miles by rail to Port Clinton, at which point coal is transhipped into boats, and sent by water to Philadelphia, 85 miles; New York, 198 miles; Havre de Grace, 164 miles.

Port Carbon has direct water communication with Philadelphia, 106 miles; New York, 220 miles; Havre de Grace, 180 miles; Baltimore, 234 miles. It has direct railroad communications with New York, 169½ miles; Philadelphia, 95½ miles; Baltimore 152½ miles; Elmira, 238½ miles.

Pottsville has direct water communication with Philadelphia, 104 miles; New York, 218 miles; Havre de Grace, 180 miles; Baltimore, 224 miles; Elmira, 373 miles. It has direct railroad communications with Philadelphia, 93½ miles; New York, 169½ miles; Baltimore, 152½ miles; Elmira, 236½ miles.

Pine Grove, on the Union Canal Feeder, is four miles from the mines. It has direct water communication with Havre de Grace, 115 miles; Baltimore, 169 miles; Philadelphia, 149 miles.

Millersburg is the shipping point from the Lykens Valley mines. It is 16 miles by rail from the mines, and has direct water communications with Havre de Grace, 104 miles; Baltimore, 158 miles; Philadelphia, 153 miles; Buffalo, 447 miles; Syracuse, 327 miles, and Albany via the Delaware and Hudson canal, and Pennsylvania Coal Co's railroad and Hudson river, 307 miles.

Wiconisco, at the Lykens Valley mines, has direct railroad communications with Baltimore, 128 miles; Elmira, 160 miles; Philadelphia, 166 miles.

The following statement shows the total quantity sent over each route from the Schuylkill Basin, from 1820 to 1863 inclusive:

	Tons.
Transported over Lehigh canal	9,510,052
" " Phila. & Reading railroad	28,846,670
" " Schuylkill canal	19,686,125
" " Union canal	1,399,472
" " Lykens Valley railroad	1,263,762
" " Dauphin & Susquehanna railroad	182,625
" " Lehigh Valley railroad	475
Total	60,899,181

Actual Cost of Anthracite Coal, and Distances to Market from Schuylkill Basin.

Gold at Par.

(For Rates of Transportation on Canals, Railroads, and cost Mining, see Appendix B.)

	Miles in route of—				Cost of Ant. coal delivered on the docks.		
	Railroad.	Canal.	River & Bay.	Total distance.	Lowest.	Highest.	Average.
From Mauch Chunk Mines:					No. 1.	No. 2.	
New York via Lehigh and Morris canals	10	148	1	159	$3 22	$3 65	$3 43
" Lehigh Val. & N. J. Cent. R. R.	130	....	1	131	2 50	4 23	3 37
" " R. R. & Morris canal	55	102	1	158	3 02	3 84	3 43
" " Del., Flem'gton & N. J. R.R.	170	....	1	171	3 19	5 32	4 25
" " " Del. & R. canal.	110¼	43	34	187½	3 25	4 55	3 90
Philadelphia via Lehigh Val. and N. Penn. R. R.	101	....	....	101	2 22	3 50	2 86
" " & Del. Division canals	10	106	17	133	2 68	3 01	2 84
" " Val. R. R. & Del. canals	56	60	17	133	2 51	3 33	2 92
Havre de Grace via Lehigh Val., N. Penn., P. W. & B. R. R.	163	....	....	163	2 78	4 82	3 80
Baltimore via Lehigh, Del. Ches. & Del. canals	10	119	127	256	3 13	3 64	3 38
" " Val., N. Penn. & P. W. & B. R. R.	200	....	....	200	3 07	5 61	4 34
" " Val., E. Penn., R. & C., N. C. R. R.	190	....	....	190	2 98	5 39	4 18
" " Val., Del. Ches. & Del. canal	56	73	127	256	3 12	3 97	3 54
Albany via Lehigh & Morris canals & H. River	10	148	160	318	3 70	4 11	3 90
From Tamaqua Mines:							
New York via Schuylkill, Del. and Raritan canals.	20	135	70	225	3 44	4 13	3 78
" Quakake, L. Val. & N. J. Cent. R.R.	164	....	1	165	3 00	4 95	3 97
" Schuylkill, E. Penn. & " "	163	....	1	164	2 99	4 94	3 96
Philadelphia via Catawissa, Phila. & Reading R. R.	98	....	....	98	2 28	3 58	2 93
" Schuylkill R. R. & canal	20	88	....	108	2 60	3 20	2 90
Elmira via Catawissa, W'msport & Elmira R. R.	177	....	....	177	3 59	5 10	4 34
Buffalo via " " Erie.	327	....	....	327	4 97	8 36	6 66
From Pottsville & Port Carbon Mines:							
Philadelphia via Schuylkill canal	2	106	....	108	2 60	3 08	2 84
" Phila. & Reading R. R	95	....	....	95	2 25	3 52	2 88
New York via Schuylkill, Del. & Raritan canals	2	149	70	221	3 41	3 96	3 68
" Phila. & Read., E.Penn. & N.J.C RR.	160	....	1	161	2 98	5 00	4 00
H. de Grace via Schuylkill, Union & Susquehanna.	2	180	....	182	3 22	3 67	3 44
" " Ches. & Del. canals	2	119	66	187	3 03	3 53	3 28

	Miles in route of—				Cost of Ant. coal delivered on the docks.		
	Railroad.	Canal.	River & Bay.	Total distance.	Lowest.	Highest.	Average.
H. de Grace via Phila. & Read'g, B. & C. RR. & T. W. canals	83	45	....	128	No. 1. $2 67	No. 2. $3 85	$3 26
Baltimore via Susqueh'a & Schuylkill & N. C. RR.	158	....	....	158	2 84	4 85	3 84
" Phila. & R., R. & Col. N. C. RR.	153	....	....	153	2 78	4 75	3 66
" Schuylkill, Ches. & Del. canals.	2	119	107	228	3 20	3 69	3 44
" " Union & Susqueh'a canals	2	180	54	256	3 44	3 89	3 66
From Tremont Mines:							
H. de Grace via Union & Susquehanna canals	6	112	....	118	2 58	2 92	2 75
Baltimore via " " "	6	112	54	172	2 79	3 14	2 96
" Susq. & Schuylkill & N. Cent. R.R.	133	....	....	133	2 61	4 32	3 46
Philadelphia via " " Phila. & Read. RR.	108	....	....	108	2 38	3 79	3 08
" Union & Schuylkill canals	6	142	....	148	3 17	3 43	3 30
From Dauphin Mines:							
Baltimore via Susquehanna canals	12	85	54	151	2 56	2 91	2 73
" Northern Central railroad	104	....	....	103	2 40	3 71	3 06
Havre de Grace via Susquehanna canals	12	85	....	97	2 35	2 69	2 52
Philadelphia via Susqueh'na & Union & Schuylkill.	12	163	....	146	3 00	3 75	3 37
" Pennsylvania railroad	139	....	....	139	2 76	4 44	3 60
" Phila. & Reading railroad	132	....	....	132	2 69	4 30	3 49
From Lykens Valley Mines:							
Baltimore via Susquehanna canals	16	104	54	174	2 75	3 20	2 92
" Northern Central railroad	128	....	....	128	2 65	4 22	3 43
Havre de Grace via Susquehanna canals	16	104	....	120	2 53	2 98	2 75
Elmira via Wyoming, N. Br. & Junction	16	215	....	230	3 61	4 15	3 88
Buffalo via " " "	16	412	35	463	4 55	5 60	5 07
Syracuse via " " "	16	292	35	343	4 17	5 00	4 58
" Lackaw'na, Del., L. & W. S. & Bing. railroad	239	....	....	239	3 28	5 96	4 62
Philadelphia via Susque., Union & Schuylkill canals	16	182	....	198	3 40	3 85	3 62
" Pennsylvania railroad	166	....	....	166	3 69	5 03	4 36

The following rates are used in determining the cost of coal in the foregoing and following statements. (See Appendix B.)

Classification and Routes.	Rates used for columns. No. 1.	No. 2.
Cost of mining, per ton	$1 37	$1 50
" transhipments	10	12
" " from rail at Jersey C. to N. Y.	35	85
" mining Cumberland	75	88
Transportation on canals, miiis per ton per mile.		
Erie canal (boats 210 tons)	3 21	5 00
" " 85 "	4 21	6 00
Chenango canal	7 03	11 34
" extension	6 25	10 56
Cayuga & Seneca	3 35	5 15
Chemung	7 92	12 23
Junction	14 70	15 70
North Branch	9 42	10 42
Wyoming	8 08	9 08
W. Br. Susquehanna Division	8 08	9 08
Penn. Susquehanna "	8 16	9 16
Susquehanna and Tide Water	9 60	10 60
West Branch	8 06	9 06

Classification and Routes.	Rates used for columns. No 1.		No. 2.
Delaware and Hudson	9 40	......	14 50
Lehigh Nav. and canal	9 66	......	10 66
" "	11 41	......	11 62
Morris canal	10 81	......	11 62
Schuylkill canal	10 48	......	13 42
New York Bay (34 miles)	4 00	......	4 00
Delaware and Raritan	12 42	......	14 00
Penn. Delaware Division	9 08	......	10 08
Chesapeake and Delaware	12 58	......	14 00
" "	12 60	......	13 62
" Ohio	6 30	......	8 50
Juniata Division	9 42	......	10 42
Union canal	9 86	......	10 86
Hudson river (160 miles)	1 23	......	2 90
" 64 "	2 26	......	7 80
Seneca Lake	3 10	......	5 10
Delaware and Chesapeake Bay (boats 300 tons)	2 72	......	3 00
" " " 85 "	4 00	......	4 00
Ocean (sail)	1 03	......	2 50
Railroads:			
Barclay Coal Co's.	10 00	......	14 37
Lykens Valley	8 50	......	24 50
Tioga	6 74	......	14 87
Lehigh Valley	7 61	......	18 70
Elmira and Williamsport	18 00	......	20 50
Pennsylvania Coal Co's	9 90	......	13 00
Huntington and Broad Top	5 25	......	20 10
Syracuse and Binghamton	5 50	......	13 70
Baltimore and Ohio	10 00	......	18 60
New Jersey Central	6 37	......	18 00
Delaware and Hudson Canal Co's	4 57	......	10 00
Erie Railway	9 00	......	20 90
For all roads not given	9 28	......	21 26

2d. Middle District.

The western limits of this basin are at Trevorton, averaging about 8 miles from the Susquehanna river, and extends easterly 34 miles, with a maximum width of 4 miles. The total length of railroads and branches, within the limits of this basin (which embraces the Beaver Meadow mines), is 160 miles. The following statement shows the area of this basin :

	Acres.
Shamokin district	32,270
Mahony	26,330
Beaver Meadow, Hazelton, Big and Little Black Creeks	22,400
Total area, Middle Basin	81,000

The total quantity of coal mined and sent to market, from 1820 to 1863 inclusive=19,295,929 tons, and during the year 1863=699,558. The mines worked by the Lehigh Navigation Co., and the quantity mined and sent to market from each, is as follows in 1863 :

	Tons.
Panther creek and Summit mines	380,302
East Lehigh mines	30,387
Room Run "	80,166
Tamaqua "	25,816
Total	517,259

Passed into the Morris canal.	208,396
" " Delaware Division canal	376,996

Since the destruction of the Lehigh canal, in 1862, by a freshet, coal formerly shipped at Penn and White Haven is now transported by rail 21¼ (average length from the mines) miles to Mauch Chunk, and there transhipped into boats and sent over the Lehigh, Morris, also the Lehigh and Delaware Division canals.

The Nesquehoning railroad was constructed to develope the Lehigh Coal Navigation Co's mines, and makes a connection with the Catawissa road, shortening the original distance 12 miles.

The Hazleton Railroad Co. constructed a road to the top of the mountain, from which the coal is let down an inclined plane from an elevation of 430 feet in a distance of 1,200, and sent 12 miles to Penn Haven. The loaded cars descending draw up the empty cars at the plane. Another plane was constructed by this company from the mines to the level of the Beaver meadow railroad, and the coal sent over the Lehigh Valley road. Hazleton is about 1700 feet above tide-water. There are eleven openings within two miles of the village, capable of producing 250,000 tons per annum.

Eckley is at the top of Buck Mountain and the same elevation above tide-water as Hazleton. The coal from these mines is pronounced of superior quality for locomotive purposes. The coal is brought over the Hazleton road, 14 miles, to Penn Haven. These mines are capable of producing 120,000 tons annually.

The Stockton mines are worked from three slopes, yielding in the aggregate 150,000 tons per annum. Hazle Creek is 1½ miles from Weatherly, 15½ from Mauch Chunk, and 7½ from Penn Haven. 1¼ miles below Weatherly the Quakake railroad, 13 miles long, connects with the Beaver Meadow railroad.

The principal shipping points from this district, are Ashland, Shamokin, Trevorton, besides those already enumerated.

White Haven is situated at the head of the Lehigh canal, 16 miles above Penn Haven, and 20 miles south of Wilkesbarre via the Lehigh and Susquehanna railroad, completed in 1864. Previous to 1862 there was a direct water communication via the Lehigh and Morris canal, 174 miles to New York; but since the freshet of that year, only that part of the Lehigh canal between Mauch Chunk and Easton, 46 miles, is in use.

Penn Haven lies also on the impaired portion of the Lehigh canal, and the converging point of all the branches from the

Beaver Meadow mines. The branch from Minersville mines to Penn Haven is 18½ miles; from Hazleton mines 13¼, Jeddo 12, Eckley 12, and from Buck Mountain mines 8½ miles; making the average length of railroad from the Beaver Meadow mines to Penn Haven 12½ miles, and to Mauch Chunk, the point of transhipment by canal, 21¼ miles. From Mauch Chunk to New York, via Lehigh and Morris canals, it is 148 miles, and to Philadelphia, via the Lehigh and Delaware Division canals, 123 miles. The shortest railroad lines from the Beaver Meadow mines, to New York, is 142 miles to Jersey City and 131 to Elizabethport. The expense of transhipment to the city of New York from the latter point, in 1861, being 35 cents per ton, and in 1864, 75 cents.

Mahony city lies on the East Mahony railroad, and the coal is carried over the Mahony City and Broad Mount railroad, 14 miles, to Port Carbon on the Schuylkill canal, and shipped into boats. Coal is also sent to Penn Haven, 25 miles, over the Quakake, Lehigh and Mahony, and Beaver Meadow railroads, and to Mauch Chunk, 35 miles. Ashland is 13½ miles from Port Carbon, and 35 miles from Penn Haven by railroad.

Shamokin is 38½ miles by railroad to Schuylkill Haven, where the coal is shipped into boats and sent over the Schuylkill canal, 100 miles, to Philadelphia; Shamokin has direct railroad communication with Susquehanna canals at Sunbury, 21 miles, where the coal is transhipped into boats of 85 to 100 tons burthen, and sent 130 miles to Havre de Grace, 184 to Baltimore, 256 to Philadelphia, 421 to Buffalo, 301 to Syracuse, 188 to Elmira, and 211 to Watkins, at the head of Seneca Lake.

The Trevorton mines are 13½ miles by railroad to Port Trevorton, on the Susquehanna canals. Port Trevorton is 11 miles south of Sunbury. (See map.)

The following statement shows the quantity sent over each route to market from the Middle Coal Basin, from 1820 to 1863 inclusive:

	Tons.
Transported over Lehigh canal	12,053,454
" " Valley railroad	2,328,475
" Reading and Schuylkill canal	2,350,000
" Shamokin railroad	1,697,598
" Trevorton railroad	804,321
" McCauley's Mount railroad	61,981
Total mined and sent to market from 1820	19,295,929

Actual Cost of Anthracite Coal, and Distances to Market from Middle Basin.

Gold at Par.

(For Rates of Transportation on Canals, Railroads, and cost Mining, see Appendix B.)

	Miles in route of—				Cost of Ant. coal delivered on the docks.		
	Railroad.	Canal.	River & Bay.	Total distance.	Lowest.	Highest.	Average.
Beaver Meadow Mines :					No. 1.	No. 2.	
New York via Lehigh Val. & N. J. Cent. railroad..	142	....	1	143	$2 61	$4 45	$3 53
" " R.R., Lehigh & Morris can'ls	22	148	1	171	3 28	3 78	3 58
Philadelphia via " " Del. canals..	22	106	17	145	2 75	3 23	3 00
" " Valley & N. Penn. railroad..	113	....	....	113	2 33	3 74	3 03
From Ashland Mines :							
New York via Quakake, L. Val. & N. J. C. R.R..	165	....	1	165	2 96	4 97	3 96
" " " Lehigh & Morris .	45	148	1	194	3 43	4 17	3 80
Philadelphia via M. Bd. Top R.R. & Schuylkill ca'l	14	106	....	120	2 99	3 22	3 10
" " Phila. & Read'g.	109	....	....	109	2 46	3 81	3 13
From Trevorton Mines :							
Buffalo via N. Cent. & Erie Buffalo Division.......	300	....	....	300	4 15	7 76	5 95
" Wyoming, N. Br., Junction & N. Y. S	14	401	35	450	4 45	5 20	4 86
" W. Br. canal, W. & Elmira & Erie	249	53	....	302	4 34	7 25	5 79
Syracuse via Wyoming, N. B., Junc. & N.Y.S. ca'ls	14	281	35	330	4 06	4 80	4 43
" B. & Lack., Del., L. & W., S. & B. RR.	254	....	....	254	4 42	6 51	5 46
Rochester via W. Br. N. C. & Canandaigua	191	53	....	244	3 56	6 19	4 87
Havre de Grace via Susquehanna canals	14	119	....	133	2 64	3 04	2 84
Baltimore via Susquehanna canals................	14	119	54	187	2 85	3 26	3 05
" Northern Central railroad	141	....	....	141	2 77	4 49	3 63
Philadelphia via Susque., Union & Schuylkill	14	197	....	211	3 65	4 05	3 85
" Penn. railroad.................	179	....	....	179	3 87	5 30	4 58
From Shamokin Mines :							
Buffalo via Shamokin, N. C. & Erie railroad	296	....	....	296	4 72	7 71	6 21
" Wyoming, N. Br., Junc. & N. Y. S. c'ls	21	386	35	442	4 40	5 17	4 78
Rochester via " " " "	21	293	35	349	4 11	4 87	4 49
Syracuse via " " " "	21	266	35	322	4 00	4 78	4 30
" Del. & Lack., Del., L., W., S. & Bing.	246	....	....	246	3 35	6 22	4 78
Havre de Grace via Susquehanna canals	21	130	....	151	2 93	3 28	3 10
Baltimore via Susquehanna canals................	21	130	54	204	3 14	3 50	3 33
" Northern Central railroad..........	159	....	....	159	2 85	4 87	3 86
Philadelphia via Shamokin, Phila. & Reading.....	185	....	....	185	3 22	5 43	4 37
" " R.R. & Schuylkill ca'l.	36	100	....	136	2 88	3 68	3 28

3d. *Northern, or Wyoming and Lackawanna Basin.*

This basin extends from eight miles west of Carbondale to Shickshinny, a distance of 55 miles, with a maximum width of five miles. The total length of railroads within the limits of this basin is 140 miles, and 30 miles of canal. Its area is equal to 119,680 acres.

The total quantity of coal mined and sent to market, from 1829 to 1863 inclusive, is 34,604,425 tons, and during the year of 1863,

3,766,374 tons. It is from this basin that the New York markets are supplied with coal. The only direct water outlet from this basin into the State of New York is the North Branch canal. Pittston is the geographical and Scranton the commercial center; the former being 95 miles by canal from the State line, and the latter 48 miles by the Delaware, Lackawanna and Western railroad.

Three veins underlie this district, cropping out on the face of hills surrounding it. Of these one has a thickness of from 20 to 28 feet. The general direction of the basin is south-west.

Carbondale is the principal mining point of the Delaware and Hudson Canal Co. The coal is carried over their road 13 miles to Honesdale, and there shipped into boats of from 115 to 120 tons burthen, and sent 108 miles to Rondout, and from thence 64 miles by the Hudson River to Albany, and 96 miles to New York.

Scranton is the next in importance, and lies on the Delaware, Lackawanna and Western railroad, 17 miles by rail from Carbondale; 30 miles to Honesdale (at the head of the Delaware and Hudson canal); 48 miles from the Junction with the Erie railroad at Great Bend; 122 miles from Elizabethport; 143 miles from Syracuse; 203 miles from Albany, via the Albany and Susquehanna railroad. The Lackawanna and Bloomsburg railroad connects here with the other roads mentioned, and continues westerly, through the central portion of the basin, 80 miles to Northumberland. The first colliery on the Lackawanna river, below the Oxford mines, is three miles from Scranton. At Lackawanna, six miles below Scranton, iron ore is found. Between Taylorville and Pittston there are three collieries.

Pittston, 9¾ miles from Scranton, lies at the head of the Wyoming Valley, and at the junction of the Lackawanna with the Sushanna river. From this point the North Branch and Wyoming canal passes through the remaining portion of the valley, 74 miles to Northumberland, and to tide-water at Havre de Grace 206 miles; to Elmira 113 miles. The Pennsylvania Coal Co's railroad also contributes to the commerce of the Delaware and Hudson canal from the Pittston mines. The railroad extends from Pittston, 47 miles, to Hawley on the Delaware and Hudson canal. It has an ascent and descent of 2250 feet, overcome by 22 planes operated by 23 stationary engines and gravity. The cost of transporting a ton of coal per mile over this road in 1863, was (from the report of the company) $9\frac{9}{10}$ mills. This road cost two million dollars; gauge, 4½ feet; weight of rail, per yard, 15 pounds. It


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has one tunnel 800 feet long. 750,000 tons of anthracite coal were transported in 1863 over the road to Hawley. The earliest settlers here were from Connecticut, and their rights being contested by the Pennsylvania land-holders, gave rise to the "Pennamite" war, ending only by the commencement of the Revolutionary war, which made the valley celebrated for Indian atrocities upon the settlers, by the tribes of the six nations.

Kingston, 7¼ miles below Pittston, is an important shipping point for coal mined in its vicinity.

Wilkesbarre is one mile below and on the opposite side of the river to Kingston, and the dividing point between the North Branch and Wyoming canals. Above the town there are three collieries, and within two miles below are the Empire, Stanton, Blackman's and Hartford collieries, and the consolidated mines. The town contains an anthracite blast furnace, and one of the largest rolling mills in the country.

Shickshinny, the south-western limits of the coal basin, is 30 miles from Scranton. There is a large furnace near the village of 2000 tons annual capacity.

Bloomsburg is 56 miles below Scranton, and 24 from Northumberland. A short distance below Rupert the Lackawanna and Bloomsburg railroad connects with the Catawissa, also the Northern Central at Northumberland. The country between Rupert and Dansville abounds in iron ore.

Northumberland suggests the villages often met on the Rhine and in the cantons of Switzerland. It is situated at the junction of north and west branches of the Susquehanna river, also the canals of the same name. The distance by railroad to Scranton is 80 miles; to Philadelphia, 167, and 223 via Scranton to New York.

The following statement shows the total quantity of coal mined and sent to market from the 3d. *Wyoming & Lackawanna District*, also the quantity sent over each route, from 1820 to 1863 inclusive:

	Tons.
Transported over the Delaware and Hudson canal.....	11,281,690
" " Penn. Coal Co's railroad	7,429,897
" " North Branch canal............	7,426,296
" " Del. Lackawanna railroad......	7,665,238
" " Lehigh & Susquehanna R. R...	765,304
Total mined and sent to market since 1820.....	34,604,425

Actual Cost of Anthracite Coal, and Distances to Market from Wyoming and Lackawanna Basin.

Gold at Par.

(For Rates of Transportation on Canals, Railroads, and cost Mining, see Appendix B.)

	Miles in route of— Railroad.	Canal.	River & Bay.	Total distance.	Cost of Ant. coal delivered on the docks. Lowest.	Highest.	Average.
From Scranton Mines:					No. 1.	No. 2.	
Syracuse via Del., L. & W. Erie, S. & Bing......	143	....	....	143	$2 40	$3 94	$3 17
Rochester " " Can'dagua & Central..	220	....	....	220	3 41	6 17	4 79
Buffalo " " Erie B. Branch.......	278	....	....	278	3 95	7 40	5 67
Utica " " RR. & Chenango canal	63	97	....	160	2 64	4 06	3 35
Albany " " " " Erie "	63	207	....	270	3 00	4 73	3 86
" " " & Alb'y & Susquehanna	203	....	....	203	3 25	5 60	4 42
New York " " & N. J. Central RR...	144	....	1	145	2 96	4 71	3 83
From Pittston Mines:							
Buffalo via N. Branch, Junction & N. Y. S. canals.	....	315	35	345	3 48	4 22	3 85
" " Chenango extension	....	473	....	473	3 85	5 25	4 55
" " canal & Erie railroad......	150	113	....	263	4 08	6 04	5 06
Rochester " Junction & N. Y. S. canals.	....	217	35	252	3 19	3 76	3 47
" " Chenango extension.......	....	380	....	380	3 55	4 78	4 16
" " Junction & E. & C. RR...	99	113	....	212	3 73	4 97	4 35
Syracuse " " N. Y. S. canals.	....	190	35	225	3 10	3 63	3 36
" " Chenango extension.	....	287	....	287	3 25	4 35	3 80
" Del., L. & W. RR., Cayuga Lake & ca'ls	120	40	40	200	......	......	.....
" N. Br. & Junction canals, S. & Bing...	138	113	....	251	3 59	5 19	4 39
Utica via " " & N. Y. S. canals...	....	246	35	281	3 28	3 90	3 59
" " Chenango extension	....	231	....	231	2 98	3 82	3 40
" Penn. RR., Delaware & Hudson canal...	47	209	64	320	3 47	4 85	4 16
" From Carbondale " " " ..	13	218	64	295	3 13	4 48	3 80
" Del., L. & W., Erie RR. & Chenango ca'ls	63	97	....	160	2 63	4 06	3 34
" N. Br. canal, Erie RR. & Chenango	42	197	....	239	3 69	4 71	4 20
Albany via " Junction & Erie canals....	....	356	35	391	3 63	4 45	4 04
" " Chenango extension.............	....	341	....	341	3 42	4 59	4 00
" Delaware and Hudson canal...........	47	99	64	210	3 03	4 18	3 60
" (From Carbondale) Hudson canal......	13	108	64	185	2 69	3 81	3 25
New York via " " "	13	108	96	217	2 76	4 05	3 40
" " " "	47	99	96	242	3 10	4 42	3 76
" L. & Susquehanna & N. J. Cent. RR.	174	....	1	175	3 04	5 28	4 16
" Del., L. & W., Warren & N. J. C. RR.	156	....	1	157	2 95	4 90	3 92
From Wilkesbarre Mines:							
New York via L. & Susqe., L. Val. & N. J. C. RR.	165	....	1	166	2 77	4 96	3 86
" " RR., L. & Morris ca'l..	45	148	1	194	3 45	4 17	3 81
Philadelphia via " L. Val., N. Penn. RR.	135	....	....	135	2 50	4 21	3 36
" " Lehigh & Del. canals..	45	106	17	168	2 93	3 66	3 29
" Wyoming, Union & Schuylkill c'ls.	....	274	....	274	4 09	4 34	4 31
H. de Grace via " & Susquehanna	....	196	....	196	3 16	3 34	3 25
Baltimore via " "	....	196	54	250	3 38	3 56	4 47
" L. & Bloomsburg & N. C. RR....	....	....	....	.....	......	......	.....
Buffalo via N. Br. Junction & N. Y. S. canals.....	....	320	35	355	3 57	4 33	3 95
" L. & Bloomsburg, N. C. & Erie RR....	326	....	....	326	4 40	8 30	6 35
" W. Br. canals & " "	228	115	....	343	4 43	7 62	6 00


BROOKLYN
Westfield
NORWICH AND
Willimantic
Plainfield
RHODE ISLA
WILLIMANTIC
NORWICH
NEW LONDON
ERIE RAIL
Port Jervis
NEW LONDON
STONINGTON
Fisher's Isd.
THE RACE
Little Gull I.
Great Gull I.
Plum I.
Gardiners Island
MONTAUK Pt.
Sag Harbor
Hampton
NEWTOW
MORRIS
OCEAN
JERSEY CEN. R.R.
DEL. & RAR

Selling Price of Domestic Coal, October, 1861 *and* 1864.

	Selling Price—Average in October, 1861	Selling Price—Average in October, 1864	Percentage of increase of 1864 over 1861.
Buffalo market, domestic (wholesale)	$4 50	$11 00	140
Rochester market, domestic (retail)	6 00	14 00	136
Syracuse " "	3 55	10 75	200
Utica " " (retail)	4 70	11 00	134
Albany " " "	5 37	12 00	123
" " " on docks	4 12	10 75	160
New York " " (retail)	4 50	9 50	110
Philadelphia " " "	3 51	9 00	156
Boston " " "	5 50	13 50	145
Average	....	....	145

Description of Bituminous Coal Fields of Pennsylvania and Maryland, and Routes to Market.

Bloosburg Mines.

Before the enlargement of the Cayuga and Seneca and Erie canals, coal from these mines was sent over the Tioga railroad, 40 miles, to Corning, and there shipped into boats of 70 to 80 tons burthen, and carried to the Erie canal markets. Since the completion of the enlargement of the above canals, all the coal from the new extensive mines of John McGee, Esq., is sent by railroad from Bloosburg, 80 miles, to Watkins (at the head of Seneca Lake), and there shipped into boats of 210 tons burthen, and carried to Buffalo, 209 miles; Rochester, 116 miles; Montezuma, 56 miles; Syracuse, 89 miles; Oswego, 127 miles; Utica, 145 miles; Albany, 255 miles, and New York, 405 miles, from Watkins.

The character of this coal is: Percentage of carbon, 73.4; steam (of 212°) evaporated, per lb., 10.9; quantity of heat by volume, 85; percentage of coke, by weight, .83.

Barclay Mines.

The only outlet from these mines into this State, is by the North Branch and Junction canals. The coal is brought over the Barclay railroad, 16 miles, to Towanda, and there shipped into boats of 85 tons burthen, and sent to Athens, 15 miles; Elmira, 38 miles; Watkins, 61 miles. At Watkins the coal is transhipped into boats of 210 tons burthen for distant ports on the Erie canal.

It would be economy to tranship if the distance to be transported from Watkins exceeded 50 miles. The total distance of these mines from Watkins, by canal, is 77 miles; Bloosburg mines, by rail, 80 miles—the point of transhipment from both mines.

These mines were not considered practically in operation previous to 1854. In relation to the facilities and working condition of these mines, Col. O. W. Childs, in his report on the Chenango canal extension, remarks, that "the Barclay Railroad Company forwarded, in 1858, 16,000 tons, and in 1859, 30,000 tons, of which only 18,482 tons came into this State by canal. Their road, machinery and mines appear to be in good working order, and although the quantity shipped in 1859 was less than double that of 1858, (a year of the early use and interrupted employ of the road, added to the delays consequent upon seeking and introducing their coal to a new and untried market,) the company being more fully prepared, now contemplate doing a much larger business another year, and with some additional motive power could, in a single season, send forward "120,000 tons."

Value of the Barclay Coal.

In relation to the character of the coal from these mines, the following is taken from Col. Childs' report:

The board of directors, in a report to the stockholders, in 1857, remark: "The coal is semi-bituminous, and corresponds with the Cumberland and Broad Top coals. It is peculiarly well adapted for generating steam, and is in high favor with iron workers, while many give it a decided preference as a house fuel. The vein is six feet in thickness, and lies above water level, in nearly horizontal strata, but having sufficient dip to drain the mines without the expense of pumping; and in relation to facilities of transit, they say: "one cent per mile is a liberal estimate for the cost of carrying coal over the road with its favorable descending grades, consequently about 16½ cents per ton would be the cost of the coal, exclusive of its value, in the mines, and the cost of mining and placing it in the railway cars."

The general superintendent, James McFarland, Esq., in his annual report to the President of the Company, in 1858, describes this coal "as containing a large percentage of carbon, very little volatile matter and bitumen, with but little ash; it burns freely and without much smoke, and is well adapted for steam purposes and the manufacture of iron, when a strong blast and great heat are required. It contains carbon, 81 to 85 per cent; volatile matter, 11 to 15; ash 3, or thereabout. Also, that it burns out clear, leaving but little clinker. No other fuel has been used in our locomotives than coal from our own mines."

Again, in 1859, the superintendent, in stating its qualities for generating steam, says: "It ignites very readily, burns with a bright, cheerful blaze, and being free from sulphur, it does not injure the boilers, deposits no soot upon the flues, and has great heating and evaporat-

ing power. It has been successfully used in steamboats, as well as under stationary engines; in the manufacture of salt and glass; for heating purposes in distilleries and factories; for burning lime, and in locomotive engines, rolling mills and forges, and has given good satisfaction to all our customers."

I would here remark, that I have been favored with copies of twenty-nine certificates, from gentlemen residing in different parts of the State, based upon tests made by them, and bearing high testimony to its good, and in most instances to its superior quality, for the several purposes above named, in which might be included general smithery, and in the manufacture of paper, &c.

In relation to its economy and adaptation for use in locomotive engines, F. Leech, Esq., superintendent of motive power on the Susquehanna and western division of the New York and Erie railroad, in a report to the president of that road, says of its economy, after a careful test for several months, on 96 miles of that road, that it proved forty-seven and three-tenths per cent cheaper than wood, reckoning the cost of the former at $2.70 per ton, and the latter at $3 per cord, all delivered in the tender. And in regard to its general quality, he says: "I have no hesitation in stating that it is decidedly superior to any other we have tried; our experiments for shop use have shown it to be almost entirely clear of sulphur, and the absence of clinker or slag in the furnaces of the locomotives, indicates it to be clear of the injurious impurities which have proved objectionable in the coal used in our previous trials."

In relation to the distribution of coal from these mines, Col. Childs adds:

"The quantity of coal cleared north, the past season, at the office of the North Branch Canal Company, at Athens, previous to the 31st Oct. last, was 68,513, of which 50,031 tons was anthracite, from the Wyoming valley, and 18,482 tons was bituminous, from Tonawanda; of the latter, about one-fourth, as stated by the superintendent of the Barclay Railroad and Coal Co., stopped south of Montezuma, about one-fourth passed west, and the remaining east of Montezuma; of this latter quantity, about 8,000 tons reached Troy and Albany. A portion reached Binghamton, via the North Branch, Junction, Cayuga and Seneca, Erie and Chenango canals."

The Trevorton Mines.

These mines are situated at the outer croppings of the 2d. Middle Anthracite Coal District, in the vicinity of Trevorton, 13½ miles by the Trevorton railroad to Port Trevorton, on the Susquehanna river.

Port Trevorton has a direct water communication with the New York State canals at Elmira (via the Susquehanna, North Branch and Junction canals), 200 miles; with Havre de Grace (via the Susquehanna and Penn. canals), 119 miles; with Baltimore (via same route), 173 miles; with Philadelphia (via the Susquehanna, Union and Schuylkill canals), 197 miles.

There are also direct railroad communications from the mines to

Binghamton (via the Northern Central, Lackawanna and Bloomsburg, Delaware, Lackawanna and Western, and N. Y. and Erie railroads), 184 miles ; to Elmira (via the Susquehanna, Williamsport and Elmira railroads) 142½ miles ; with Baltimore (via Northern Central railroad), 141 miles, and with Philadelphia (via Northern Central, H. P. and Mount Joy, and Penn. railroads), 179 miles.

Lykens Valley Mines.

These mines lie at the extreme north-west corner, or arm, of the 1st. Southern, or Schuylkill District, and 16 miles by the Lykens Valley railroad to Millersburg, on the Susquehanna river.

Coal from these mines is shipped into boats of 85 tons burthen, at Millersburg, and sent by direct water communication to Havre de Grace (via the Susquehanna), 104 miles ; to Baltimore, 158 miles ; to Philadelphia (via the Susquehanna, Union and Schuylkill canals), 182 miles ; to Elmira (via the Pennsylvania, North Branch and Junction canals), 215 miles.

From these mines there are direct railroad communications with Binghamton, 187 miles ; Elmira, 160 miles ; Baltimore, 128 miles, and Philadelphia, 166 miles.

Short Mountain Mines.

These mines lie adjoining the Lykens Valley mines, and the coal is sent to market over the same routes.

Dauphin County Mines

Also lie adjoining the Short Mountain and Lykens Valley mines, and the coal is sent to market over the same routes.

Broad Top Mines.

These mines are situated between Seaton and Hopewell, on the Broad Top railroad, 36 miles from Huntingdon. Coal is sent to Seaton by a branch about eight miles long, and at Hopewell by a branch about five miles long. The mines are seven miles long and about three miles wide. The coal is sent by the Broad Top railroad, 31 miles, to Huntingdon, and there shipped into boats.

Huntingdon has a direct water communication with Harrisburg (via the Juniata & Susquehanna), 107 miles ; Havre de Grace, 183 miles ; Baltimore, 237 miles ; Philadelphia (via Juniata, Susquehanna, Union and Schuylkill canals), 261 miles ; with Elmira (via Juniata, Susquehanna, North Branch and Junction canals), 320 miles ; with New York city (via Juniata, Susquehanna, Union,

Schuylkill, Delaware and Raritan, and Bay), 374 miles; with Albany (via Juniata, Susquehanna, North Branch, Penn. Coal Co's railroad, Del. and Hudson canal and Hudson river), 412 miles.

From the mines there are direct railroad communications with Baltimore, 219 miles; Philadelphia, 241 miles; New York, 313 miles; Elmira, 268 miles.

The Cumberland Mines.

The mines are situated at and near Cumberland, at the termination of the Chesapeake and Ohio canal. It ranks among the first of bituminous coal-fields, not only in its quality, but superior advantages of transportation to the great markets of the east, and facilities for mining. It will be observed, from former statements, that this coal contains a greater percentage of carbon than the preceding coal-fields, being $74\frac{3}{10}$ per cent.

The Hampshire and Baltimore Coal Company's Mines

Embraces the Hampshire and Midland mines, consisting of 2,212 acres combined; 350 acres of which is the "big vein" coal, 14 feet in thickness.

The Hampshire Mines embraces an area of 1,933 acres, 250 of which is the big vein coal, of 14 feet seams, containing only one seam of slate. The lower seams lie above the water level, cropping out on the sides of the hills, thus avoiding the additional expense of pumping, etc., and delivering the coal direct from the shute into the cars of the Baltimore and Ohio railroad, immediately on the line, ready to be moved to market. This mine was opened in 1854. The coal is sent directly to Baltimore, and there placed into vessels of from 250 to 450 tons burthen, and sent to eastern markets. It is situated adjacent to the Baltimore and Ohio railroad station at Piedmont (206 miles from Baltimore), on the Virginia side of the Potomac, but just on the Maryland line (about 20 miles from the Pennsylvania line). The selling price of this coal, on board vessels at Baltimore, Jan. 1864, was $6 per ton, and cost $4.76 per ton, leaving a profit, after deducting sales and charges, $1 per ton. From this mine 482 tons have been mined and delivered in one day.

The Midland Mines are situated in the George's Creek valley, six miles from Frostburg and 23 miles from Cumberland, embracing an area of 279 acres, 95 of which contains the "big vein." It is estimated to yield from 10 to 12 thousand tons of coal to the acre. The thickness worked is about nine feet. This mine has facilities for

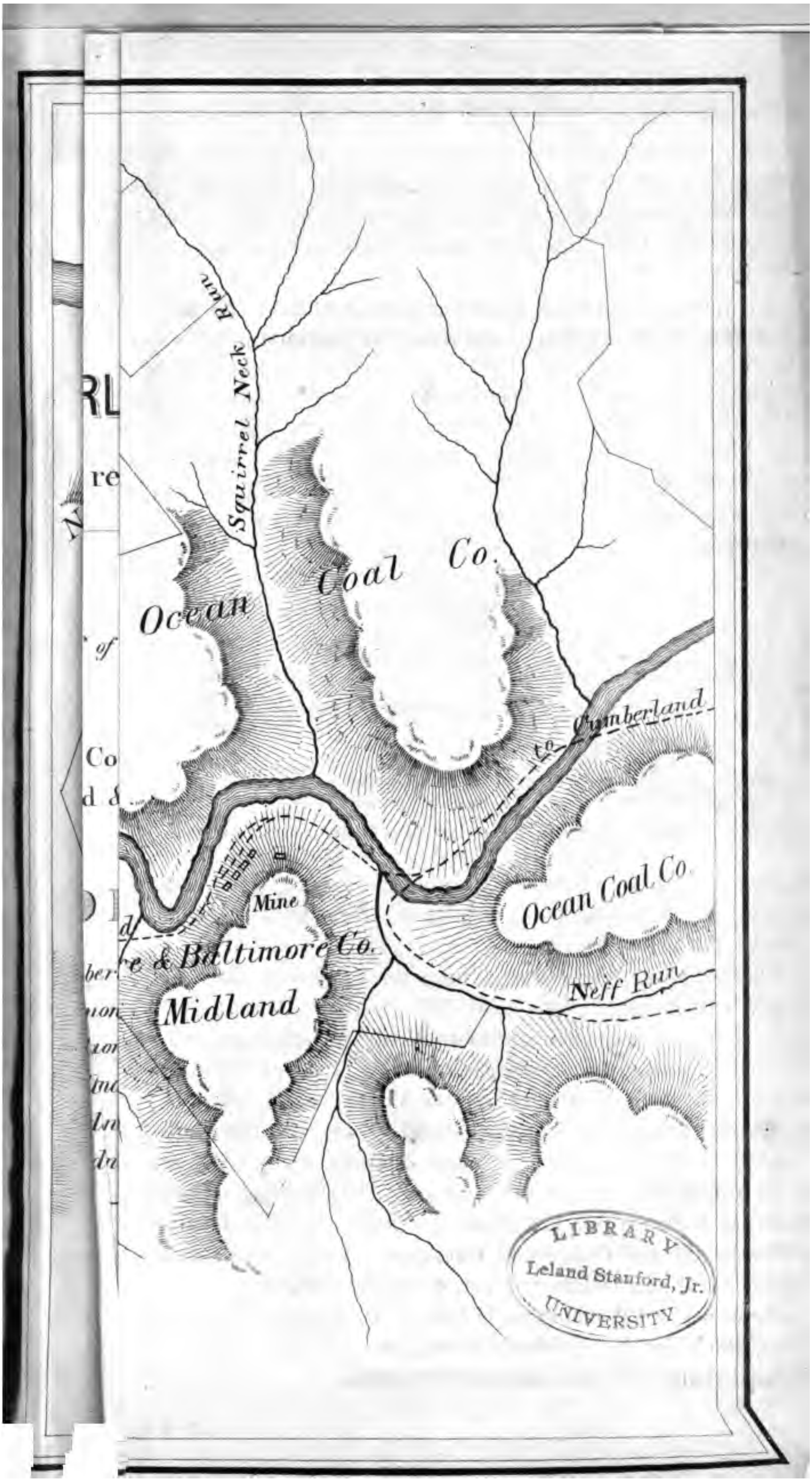
producing from 400 to 500 tons per day. The coal lies about 350 yards from the railroad, and at a slight elevation above it, so that no tramroad is required. On this account the cost of mining did not exceed, in 1863, 75 cents per ton delivered into the cars ready for market, including all expenses connected with the mines. The coal is carried by the Cumberland and Pennsylvania railroad to Cumberland, where it either goes forward to Baltimore (201 miles by rail from the mines), or shipped on board boats by the Chesapeake and Ohio canal to Georgetown, 191 miles from Cumberland. The cost of delivering coal on board vessels at Georgetown, from this mine, was $4.30 per ton, 46 cents less than by rail at Baltimore; and if the same price is obtained as at Baltimore, the profits, after deducting sales, etc., would be $1.46 per ton. The cost of delivering a ton would be divided as follows:

Cost of mining, etc., per ton	$ 75
23 miles railroad transportation, at 18⅔ mills per mile	43
Cost of transhipment into canal boats	15
Canal freight, 191 miles, at 11.63-100 mills per mile	2 22
Toll on same, 191 miles, at 3.14-100 mills per mile	60
Cost transhipment into vessels	15
Total cost in Spring, 1864, on vessels at Georgetown	$4 30
From Hampshire Mine:	
Cost of mining, etc	$ 75
206 miles railroad transportation, at 18⅔ mills per mile	3 86
Cost of transhipment	15
Total cost in Spring, 1864, on vessels at Baltimore	$4 76

The freight charges over the C. & Ohio canal, spring 1864=$2.75 per ton=$14\frac{4}{10}$ mills per ton per mile including tolls,=11¼ mills exclusive of tolls.

Cumberland has direct *water* communications with New York city (via Chesapeake, Ohio canal, 191; ocean, 530 miles), 721 miles; also (via Chesapeake and Ohio canal, 191; Chesapeake bay, 228; Chesapeake and Delaware canal, 13½; Delaware river, 78; Delaware and Raritan canal 43; New York bay, 34 miles) 587½ miles; with Albany (via last route and Hudson river, 160 miles), 747 miles; also (via ocean route and Hudson river), 867 miles; with Baltimore (via canal, 191, and bay, 163 miles), 354 miles; with Havre de Grace (via last route), 408 miles; with Philadelphia (via Chesapeake and Ohio canal, Chesapeake bay, Chesapeake and Delaware canal and Delaware river, 42 miles), 474 miles.

Georgetown and Washington is 530; Baltimore, 490, and Philadelphia, 285 miles, by the ocean from New York city; and by inland canal routes 393, 396, 243 and 103 miles.


Squirrel Neck Run
Ocean Coal Co.
to Cumberland
Ocean Coal Co.
Mine
e & Baltimore Co.
Midland
Neff Run

Cumberland has direct *railroad* communications with New York city (via Baltimore and Ohio, 178 ; Philadelphia and Wilmington, 98 ; New Jersey, 90 miles), 366 miles ; with Philadelphia, 276 miles ; with Havre de Grace, 214 miles ; with Baltimore, 178 miles ; with Albany (via Baltimore and Ohio, 178 ; Philadelphia and Wilmington, 98 ; New Jersey, 90 ; transhipped to Hudson River railroad, 144), 510—223 miles shorter than the shortest water route. The shortest distance from Cumberland to Washington, by rail, is 219 miles, and from the mines, at Piedmont, to Washington or Georgetown, 252 miles.

The following is the quantity of coal mined and sent to market by rail and canal from the Hampshire and Midland mines :

1860	By canal........	283,000 tons.	...... By rail....	505,909 tons.
1861	"	94,000 "	...... "	242,930 "
1862	"	119,000 "	...... "	120,864 "
1863	"	229,000 "	...... "	428,050 "
Totals '60 to '63 inclus'e,		725,000		1,297,753

The average burthen of vessels engaged in the coal trade to New York, is 300 tons, and the average freight charges to New York, in fore-part of the season of 1864, was $5 per ton=$9\frac{43}{100}$ mills per ton per mile.

Bituminous Coal.

The following statement shows the quantity of Bituminous Coal mined and sent to market each year from each of the fields of Pennsylvania and Maryland, also the quantity imported of Foreign Coal :

YEAR.	Import of Foreign coal.	From Bloosburg mines.	From Barclay mines.	From Trevorton mines.	From Lykens valley.	F'm Short Mountain.	From Broad Top.	From Cumberl'd.
	Total up to							
1842	1,687,916	....	....	....	....	....	....	1,708
1843	41,163	....	....	....	....	....	....	10,082
1844	87,073	....	....	....	....	....	....	14,890
1845	85,776	....	....	....	....	....	....	24,653
1846	156,853	....	....	....	....	....	....	29,795
1847	148,021	....	....	....	....	....	....	52,940
1848	196,168	....	....	....	....	....	....	79,571
1849	198,213	....	....	....	25,325	....	....	142,449
1850	180,439	....	....	....	37,763	....	....	196,848
1851	214,774	....	....	....	54,200	20,000	....	257,697
1852	183,015	....	....	....	59,857	33,639	....	334,178

upon the canals of Pennsylvania and New York for the years 1861, '62, '63, and '64; cost of mining, &c.

Appendix C shows the cost, tonnage and length of the railroads and canals of New York, Pennsylvania, New Jersey and Maryland.

Appendix D, the key to figures upon the general coal and iron maps of Pennsylvania, showing the foundry furnaces and rolling mills in Pennsylvania and the United States.

S. H. SWEET, C. E.

APPENDIX B.

COST OF TRANSPORTATION, MINING AND FREIGHT CHARGES ON COAL.

ACTUAL COST OF TRANSPORTATION ON RAILROADS AND CANALS.

The commercial value of a route depends first, upon its geographical location; and second, its capacity for the movement of freight. On canals the cost of movement depends upon the burthen of boats and the amount of lockage; on railroads, upon the grades and curves, which affect the economy of transportation.

To determine the comparative cost of transportation between railroads and canals, both should be reduced to level grades; that is, the increased expense overcoming grades and curves reduced to its equivalent of level road, and the time or detentions in passing locks, to that of uninterrupted navigation, or to a uniform speed of two miles an hour.

Thus, assuming the resistance on a level road at 20lbs- per ton, that on a 50 foot grade would be ($20 \times \frac{50}{5280}$ of 2240, or 20+21.2) $41\frac{2}{10}$ lbs. If the inclined plane was 10 miles, its equivalent of level road would equal ($\frac{41.2 \times 5280 \times 10}{20}$) $20\frac{6}{10}$ miles. Hence, if the cost of transportation over this 10 miles was nine mills, it would equal $4\frac{1}{2}$ mills per ton per mile upon a level road.

Upon the New York State canals the detentions for lockages average $11\frac{37}{100}$ feet lockage as equal to the time passing over one mile, at a speed of two miles an hour. The length of the Erie canal is $350\frac{1}{2}$ miles, and the cost of transportation, exclusive of tolls,$=2\frac{21}{100}$ mills per ton per mile. Then the cost upon a level would equal $\left(\frac{350\frac{1}{2} \times 2.21}{\frac{655}{11.37}+350\frac{1}{2}}\right)$ $1\frac{9}{10}$ mills per ton per mile.

There are three classifications under the general head of "Cost

of transportation," viz: Cost of movement, which embraces the rolling stock, motive power and help; cost of transportation, which embraces the former and interest on the cost of route; and freight charges, embracing both the former and profits to the carrier.

The actual cost of transportation, instead of freight charges, should be used for comparison between routes, as the latter fluctuates on the different routes of the same length and capacity, and on different articles; affected always by monopoly.

In the following investigation the actual cost of transportation on railroads is taken as determined on each road from experience, and where not given, the average is used. Upon canals the cost upon each is determined, based upon its capacity and amount of lockage.

Railroads.

The following statement shows the actual cost of transportation for a series of years, determined from the reports of the several railroad companies sent annually to the State Engineer and Surveyor:

Cost of Transportation on Railroads of Freight other than Coal in the State of New York.

NAME OF ROAD.	Characteristics of Road.								Cost of Transportation in Mills per Ton per Mile.																	
	Length main line in miles.	Width gauge.	Ascent in feet.		Grades in feet.		Percent'ge total length road fr gra. & curves.		1852		1853		1854		1855		1856		1862		1863		1864		Total av. each road	
			T'wrd tide water.	From tide water.	Aver. per mile.	Maximum pr mile.	T'wrd tide water.	From tide water.	Receipts.	Cost.	Receipts.	Cost.	Receipts.	Cost.	Receipts.	Cost.	Receipts.	Cost.	Receipts.	Cost.	Receipts.	Cost.	Receipts.	Cost.	Receipts.	Cost.
Through Lines—Erie railway......	446	6.00	3732	4323	18.0	60.0	46.82	53.18	19.5	10.2	25.5	12.7	26.2	12.8	24.2	11.4	24.7	11.6	18.9	9.5	20.9	9.5	23.3	14.5	24.1	11.5
N. Y. Central.....	297¾	4.71	....	....	....	....	.....	.....	30.5	15.4	36.0	15.4	30.5	16.0	32.0	15.4	29.7	14.0	22.3	13.9	23.8	15.5	27.2	20.0	29.0	15.7
Hudson river......	144½	4.71	....	....	....	....	.....	.....	31.0	16.0	24.1	16.2	22.2	18.5	37.1	30.4	35.9	25.8	22.6	12.0	27.4	13.3	....	....	....	....
N. Y. Harlem	130¾	4.71	....	....	....	....	.....	.....	49.3	36.7	33.4	29.3	33.0	14.5	39.0	22.6	49.6	31.2	37.4	28.2	38.8	32.7	55.5	49.0	42.0	30.5
Average..................	....	....	....	....	....	....	.....	.....	32.6	19.6	29.7	18.4	28.0	15.4	33.1	19.9	34.9	20.6	25.0	15.2	27.7	17.7	....	....	....	....
Nor'n. Lines—Oswego & Syracuse..	36	4.71	206	100	8.6	26.0	65.86	34.14	34.2	26.2	31.2	22.8	33.0	19.0	39.6	20.2	38.8	20.2	34.9	17.2	36.1	18.9	38.8	20.9	35.8	20.7
Rennsl'r & Saratoga.	25¼	4.71	53	457	20.0	34.0	14.78	85.22	43.6	34.7	44.4	37.0	42.1	34.6	50.8	34.2	45.5	37.6	49.0	36.4	52.5	35.2	68.5	39.3	49.5	36.1
Saratoga & Whiteh'l	40¾	4.71	410	417	17.3	....	49.64	50.36	32.8	23.1	29.5	20.6	30.0	21.0	39.6	27.8	30.5	25.6	31.1	19.6	28.3	18.0	70.0	43.4	36.5	24.9
Northern railroad...	118	4.71	1151	1294	20.7	39.0	46.89	53.11	19.5	11.5	16.0	11.7	22.6	15.0	24.1	19.0	23.5	16.7	20.5	11.9	22.9	12.8	25.4	16.6	21.8	14.4
Watertn, Rome, Ogd	189⅔	4.71	....	....	18.5	40.0	54.33	45.67	29.0	17.0	26.5	14.8	26.4	16.0	27.8	22.2	27.3	17.5	31.2	19.7	29.2	21.4	32.8	26.7	28.8	19.4
Average..................	....	....	....	....	....	....	.....	.....	31.8	22.5	29.5	21.4	30.8	21.1	36.5	24.7	33.1	23.9	33.3	20.9	33.8	21.2	47.1	29.4	34.5	23.1
So. Wtrn Lines—Buffalo, N.Y. & E.	142	6.00	892	945	18.4	46.0	48.69	51.31	56.3	23.3	40.0	22.1	28.2	18.6	32.9	21.4	28.3	19.0	20.3	12.2	19.5	13.1	18.7	20.7	30.5	18.8
Buffalo & State line	68½	4.83	416	624	15.1	36.0	40.14	59.86	54.6	45.0	54.3	30.0	32.6	18.0	24.5	12.7	21.7	16.9	27.8	14.5	27.8	14.0	32.9	21.0	34.5	21.5
Cayuga & Susque.	34⅔	6.00	644	224	25.1	79.0	72.36	27.64	26.0	19.7	23.0	18.2	22.2	16.1	25.3	15.9	27.9	16.2	26.1	16.6	26.0	20.0	29.7	24.1	25.8	18.6
Average..................	....	....	....	....	....	....	.....	.....	45.6	29.3	39.1	23.4	27.6	17.5	27.5	16.6	25.9	17.3	24.7	14.4	24.4	15.7	27.1	21.9	30.2	19.6
Eastern Lines—Troy & Boston.....	35	4.71	14.9	644	22.9	39.0	20.6	79.4	51.7	27.6	43.6	22.3	41.0	17.1	40.2	13.8	44.4	17.2	28.9	13.2	30.9	19.8	38.8	22.5	39.9	19.2
Long Island.......	94	4.71	669	663	14.8	97.0	50.15	49.85	26.0	22.8	28.0	31.3	34.3	29.0	38.7	31.5	35.5	30.2	36.6	22.9	39.0	16.8	....	....	....	....
Average..................	....	....	....	....	....	....	.....	.....	38.8	25.2	35.8	26.8	37.6	23.0	39.4	22.6	39.9	23.7	32.7	18.0	34.9	18.3	....	....	....	....
Total average...........	....	....	....	....	....	....	.....	.....	36.0	23.5	32.5	21.7	30.3	19.0	33.9	21.3	33.1	21.4	29.1	17.7	30.2	18.6	....	....	....	....

Cost of Transportation of Coal on Railroads.

But few railroad companies keep their accounts so that the cost of this class of freight can be obtained. I herewith present all the examples I have been able to obtain:

Name of road.	Actual cost.
Pennsylvania Coal Co's	10.40
Carbondale	10.00
Baltimore and Ohio	10.00
Average mills, 1852	10.13

Name of road.	Actual cost.
Erie (bet. Binghamton & Owego)	8.00
Barclay Coal Co.	10.00
Pennsylvania Coal Co.	9.00
Average mills, 1861	9.00

From Auditor General's Report, Penn. Railroad, for 1863.

NAME OF ROAD.	Characteristics		Mills per Ton per Mile.		
	Length.	Gauge.	Receipts.	Cost.	Profit.
Lykens Valley	16	4.71	24.50	8.50	16.00
Tioga	29⅜	6.00	14.87	6.74	8.13
Lehigh Valley	46	4.71	18.70	7.61	11.09
Elmira & Williamsport	78	4.71	20.50	18.00	2.50
Penn. Coal Co's	47	4.71	13.00	9.90	3.10
Huntingdon & Broad Top	31	4.71	20.10	5.25	14.85
North Lebanon	7⅜	4.71	24.00	12.50	11.50
Syracuse and Binghamton	81	6.00	13.70	5.50	8.20
Baltimore & Ohio	178	4.71	18.60	10.00	8.60
Ironton (iron)	9⅜	4.71	33.50	12.44	21.06
Pennsylvania railroad	355¾	4.71	28.00	14.00	14.00
New Jersey Central	74	4.71	18.00	6.37	11.63
Shamokin	23	4.71	29.30	13.80	15.50
Erie railway	15	6.00	20.90	9.00	11.90
Delaware & Hudson Canal Co's	30	4.25	....	4.57	....
Lehigh and Luzerne	9½	4.71	....	7.84	....
Hazleton	15	4.71	....	3.10	....
Lorberry creek	5½	4.71	....	12.18	....
Average			21.26	9.28	11.29

Cost of Motive Power on Railroads in the State of New York, in Mills per Ton per Mile.

NAME OF ROAD.	FREIGHT TRANSPORTATION. 1854						1855							1856					
	Repairs locomotives tenders.	Wood, water & stat'n attendance.	Enginemen & firemen	Fuel, cost and labor preparing same.	Cost oil and waste for loco. eng. & tender.	Total.	Repairs locomotives and tenders.	Wood, water & stat'n attendance.	Enginemen & firemen.	Fuel, cost and labor preparing same.	Cost oil and waste for loco. eng. & tenders.	Total.	Average grades, feet per mile.	Repairs locomotives and tenders.	Wood, water & stat'n attendance.	Enginemen & firemen.	Fuel, cost and labor preparing same.	Cost oil and waste for loco. eng. & tenders.	Total.
Erie railway	1.39	0.04	1.00	2.10	0.20	4.73	0.84	0.03	0.82	2.05	0.18	3.92	18.0	1.24	0.04	0.72	1.86	0.15	4.01
Buffalo, Corning & N. Y.	2.30	0.40	1.50	2.40	0.60	7.20	3.28	0.57	1.74	2.43	0.62	8.64	18.4	1.32	0.22	0.79	2.11	0.58	5.02
Rochester & Genesee Valley	......	......	......	......	......	......	2.42	0.42	1.28	1.79	0.46	6.37	16.7	2.72	0.28	1.58	2.79	0.55	7.92
Canandaigua & Elmira	......	......	......	......	......	......	3.20	0.14	1.47	4.98	0.38	10.17	23.2	2.18	0.05	1.36	3.19	0.26	7.04
" Niagara Falls	......	......	......	......	......	......	2.97	0.53	......	......	......	......	15.6	3.22	0.32	2.11	3.24	0.45	9.44
New York Central	1.20	0.18	0.70	2.30	0.30	4.68	1.69	0.20	0.81	2.49	0.53	5.72	......	1.41	0.16	0.66	1.85	0.21	4.29
Watertown & Rome	0.83	0.09	0.80	1.50	0.50	3.72	1.96	0.10	1.33	3.30	0.52	7.21	18.5	1.06	0.07	1.03	2.41	0.58	5.15
Oswego & Syracuse	1.91	0.43	1.50	1.80	1.00	6.64	1.54	0.39	1.53	2.77	0.27	6.50	8.6	1.97	0.47	1.36	3.04	0.29	7.13
Buffalo and State Line	0.72	0.19	0.70	1.30	0.20	3.11	0.65	0.13	0.36	1.90	0.10	3.04	15.1	1.64	0.24	0.39	2.64	0.14	5.05
New York & New Haven	......	......	......	......	......	......	......	......	......	......	......	......	31.9	1.88	0.09	0.63	4.12	0.43	7.15
" Harlem	0.95	0.09	0.70	3.80	0.30	5.84	1.70	0.06	0.84	4.14	0.31	7.05	18.6	1.75	0.11	1.11	4.53	0.44	7.94
Albany & W. Stockbridge	......	......	......	......	......	......	1.06	......	0.78	4.40	0.12	......	29.1	0.19	......	0.09	0.49	0.03	......
Hudson & Boston	......	......	......	......	......	......	2.65	......	1.26	7.34	0.81	......	30.9	3.79	0.01	1.57	8.14	0.39	13.90
Hudson River	1.92	0.19	0.50	2.00	0.20	4.81	2.97	0.19	0.96	5.97	0.52	10.61	......	1.46	0.19	0.72	4.76	0.32	7.45
Troy & Boston	0.71	0.13	1.30	2.30	0.30	4.74	1.05	0.12	1.06	3.64	0.32	6.19	22.9	0.92	0.14	1.11	2.58	0.24	4.99
Albany Northern	......	......	......	......	......	......	1.18	......	1.03	2.99	0.25	......	21.4	2.12	0.09	1.27	4.00	......	......
Rensselaer & Saratoga	3.61	0.12	1.20	4.30	0.60	9.83	3.25	0.18	1.26	4.36	0.50	9.55	20.0	2.62	0.05	1.07	4.41	0.40	8.55
Saratoga & Whitehall	......	......	......	......	......	......	......	......	......	......	......	......	17.3	2.50	0.02	0.96	3.09	0.34	6.91
Northern	1.23	0.12	0.60	1.10	0.10	3.15	1.45	0.11	0.78	0.19	0.11	2.64	20.7	1.03	0.13	0.75	1.17	0.12	3.20
Long Island	3.99	0.36	1.80	4.70	0.50	11.35	2.76	0.33	1.71	6.49	0.35	11.64	14.8	3.08	0.39	1.70	5.30	0.31	10.78
Average	1.73	0.19	1.02	2.46	0.40	5.81	2.03	0.23	1.12	3.60	0.37	7.09	......	1.90	0.16	1.05	3.30	0.33	6.70

CANALS.

From experiments in France, it was determined that when the sectional area of the canal was $6\frac{46}{100}$ times, and its width $4\frac{1}{2}$ times that of the boat, the conditions were then the same as the movement of the boat in an indefinite space of water.

The resistance to the movement of a boat in a canal is caused by the piling up of the water at the bow by being confined within the banks, and falling from this height escapes along the sides, producing by displacement a counter action and resistance, the more considerable as the interval between the sides of boat and canal is reduced.

No experiments of this nature have been made in this country with our build or model of boats; but it is deemed sufficiently accurate to use the formula obtained from the barges upon the Languedoc canal, as they partake of the general build of our boats.

Dubuat's formula $P'' = P'[(1-0.183)\times(1-q)\times(\frac{c}{s}-1)]$; or $P' = P\frac{8.46}{\frac{c}{s}+2}$ (where $q =$ ratio between the resistance with and without a prow; $c =$ sectional area of canal; $s =$ sectional area of boat; $P =$ resistance of a boat in an indefinite fluid, and $P' =$ that experienced in a canal). This formula was found to nearly double the resistance actually experienced on the Languedoc canal.

D'Anbuisson made a series of experiments, and corrected the formula of Dubuat, so that the resistance from calculation agreed with the observed resistance. The formula as corrected, $P'[(1-0.26(\frac{c}{s}-1)]$, or with sufficient exactness, $2.6639\frac{s^2 v^2}{c+2s} =$ lbs., was found to agree with the actual force expended.

This part of the calculation embraced in the cost of transportation covers the expense of *towing*, and is upon different canals in proportion to the resistance.

The Erie canal is taken as a basis, it furnishing the most accurate and reliable record of the expense of animal power as applied to towing, which has not for several years exceeded 25 cents a mile. The resistance at a speed of two miles an hour with boats of 210 tons burthen (the average now used) upon the Erie canal is $(2.664\times\frac{111.6^2\times2.93^2}{441+(2\times111.6)})$ 428 lbs. Before proceeding with the investigation, the following *description* and *dimensions of canals* over which the products from the coal mines are transported are given

NAME OF CANAL.	SIZE OF CANAL.				SIZE OF LOCKS.				BURTHEN BOATS.	
	Len. of main canal.	Width at surface.	Width at bottom.	Depth of water.	Number of locks.	Width of chamber.	Len. of chamber.	Am't ft of lockage.	Practical.	Theoretical.
Erie canal	350½	70	56	7	71	18	110	655	210	240
Chenango canal (present)	97	40	24	3.9-12	116	15	90	1015	70	76
" with exten'n	135½	40	24	4	135	15	90	1086	76	80
Cayuga & Seneca	21	70	56	7	11	18	110	76½	210	240
Chemung	23	42	26	5	49	15	90	491	85	90
Junction	18	42	26	4½	11	17	90	70	85	100
North Branch	105	42	26	4½	} 37	17	90	280	85	100
Wyoming	64	40	28	4½						
W. Br. Susquehanna div'n.	41	40	28	4½	......	17	90	86½	85	100
Penn. " "	46	40	28	4½	......	17	90	116	85	100
Susquehanna & Tide-water	45	40	28	4½	......	17	90	235	85	100
West Branch	76	40	28	4½	......	17	90	138½	85	100
Delaware & Hudson	108	48	30	6	107	15	100	1028	120	130
Lehigh, New & canal	72	60	45	6	81	22	100	955	74	195
Morris canal	101	40	25	5	*23	11	95	1674	74	76
Union canal	77⅔	43	28	4½	95	17	90	395	85	100
Schuylkill navigation	108¼	60	40	6	71	18	110	618½	170	186
Delaware & Raritan	43	75	47	7	18	24	110	116	270	280
Penn. Delaware division	60	44	26	6	32	11	90	166½	90	100
Chesapeake & Delaware	13½	66	46	9½	4	24	220	....	250	300
Chesapeake & Ohio	191	70	58	6	......	15	100	600	120	142
Penn. Juniata division	127	42	26	4	......	15	90	516	76	80

*23 planes, 23 locks.

Cost of Movement on each Canal.

Size of Boats.—The size of boats are taken from the general dimensions of the locks, being generally six inches less in width and from 10 to 12 feet less in length than the chamber, and the draft six inches less than the depth of canal.

Expense of Towing.—The expense of animal power is made upon each canal in proportion to the force of traction or resistance, based upon the price of 25 cents a mile, as experienced upon the Erie canal. The resistance is obtained from the formula $2.6639 \times \frac{s^2 \times v^2}{c+(2 \times s} =$ lbs., in which c = area canal, s = greatest area of boat, and v = velocity at two miles an hour, or $2\frac{93}{100}$ feet per second.

Cost of Boat, Repairs, and Crew.—The age of the boat is assumed at 10 years, and the cost of same with repairs divided into 2300 days, the aggregate length of navigable seasons. The interest on cost of boat and furniture is at 7 per cent, and the repairs assumed at 25 per cent of the cost of boat and furniture. The expenses of crew is made up of one captain, at $60 per

month, two hands, each $45, and one cook, $30 per month, making on an average about $6 per day. This is believed to be more than the actual expense on many canals, except the Erie, Cayuga and Seneca, and other night and day canals.

Cost reduced to a level.—For a correct analysis and comparison, the cost upon a level canal is shown, allowing in all cases $11\frac{37}{100}$ feet of lockage as equal to one mile, which covers all detentions (as experienced upon the old and enlarged Erie canal) for the season. The mere question of boats passing through the locks would average about 25 feet as equal to one mile, but to fall from and recover the speed of two miles an hour, with other accidental detentions, brings it down to the above standard. The formula for a cost upon a level $= \frac{(a+b)x}{11.37}$ where $a =$ total feet lockage, $b =$ actual length of canal, and $x =$ the actual cost in mills per ton per mile, including lockage.

Cost of Transportation of Coal on Canals, Rivers, Bays and Ocean.—*Gold at Par.*

NAME OF ROUTE.	Traction or Resistance.						Cost of Movement—Cents per Mile.					Cost Transportation—Mills per Ton per Mile.				
	Len. route in miles.	Burthen of boats	Area boat to area canal.	Width boat to width canal.	Resistance in lbs.	No. horses required.	Cost of motive power—towing.	Cost of boat, and furniture with interest on same.	Repairs of boat and furniture.	Expense of crew.	Total per mile.	Cost including detentions, lockages, &c.	Reduced to a level. Speed pr hour.	Reduced to a level. Cost on a level canal.	Tolls (1861).	Cost including detentions and tolls.
Erie canal	350½	210	1:3.878	1:4.00	428	2.85	25.1	6.060	0.920	14.55	46.530	2.21	2	1.90	1.00	3.21
"	350½	85	1:6.682	1:4.83	173	1.15	10.1	2.330	0.330	14.55	27.280	3.21	2	2.75	1.00	4.21
Chenango	97	70	1:2.553	1:2.75	234	1.56	13.6	3.340	0.440	24.12	42.200	6.03	2	3.14	1.00	7.03
" with extension	135¼	76	1:2.510	1:2.75	258	1.72	15.0	2.420	0.400	21.78	39.600	5.25	2	3.09	1.00	6.25
Cayuga & Seneca	21	210	1:3.878	1:4.00	428	2.85	25.0	6.870	0.390	16.50	49.420	2.35	2	1.90	1.00	3.35
"	21	85	1:6.682	1:4.83	173	1.15	10.1	2.610	0.384	16.50	29.594	3.48	2	2.64	1.00	4.48
Chemung	23	85	1:2.576	1:2.89	319	2.12	16.3	5.700	0.840	36.00	58.840	6.92	2	2.41	1.00	7.92
Junction	18	85	1:2.318	1:2.54	349	2.32	20.3	2.640	0.390	16.66	40.000	4.70	2	3.53	10.00	14.70
North Branch	105	85	1:2.318	1:2.54	349	2.32	20.3	3.620	0.311	13.33	37.561	4.42	2	3.86	5.00	9.42
Wyoming	64	85	1:2.318	1:2.42	349	2.32	20.3	3.620	0.311	13.33	37.561	4.42	2	3.86	3.66	8.08
West Branch Susquehanna division.	41	85	1:2.318	1:2.42	349	2.32	20.3	2.300	0.341	14.63	37.571	4.42	2	4.00	3.66	8.08
Penn. Susquehanna division	46	85	1:2.318	1:2.42	349	2.32	20.3	2.400	0.353	15.12	38.173	4.50	2	3.70	3.66	8.16
Susquehanna and Tide-water	45	85	1:2.318	1:2.42	349	2.32	20.3	2.890	0.426	18.38	42.000	4.94	2	3.40	4.66	9.60
West Branch	76	85	1:2.318	1:2.42	349	2.32	20.3	2.287	0.337	14.44	37.364	4.40	2	3.82	3.66	8.06
Delaware & Hudson	108	120	1:3.009	1:3.31	354	2.36	20.7	6.020	0.890	21.77	49.840	4.15	2	2.25	5.25	9.40
Lehigh navigation	72	195	1:2.680	1:2.86	567	3.77	33.0	8.570	1.350	28.47	71.390	5.41	2	1.70	6.00	9.66
"	46	74	1:6.666	1:5.71	125	0.83	7.3	3.746	0.490	28.47	40.036	3.66	2	2.50	6.00	11.41
Morris canal	102	74	1:3.439	1:3.81	200	1.33	11.7	3.000	0.395	21.56	36.705	5.00	2	2.90	5.81	10.81
Schuylkill	108¼	170	1:3.116	1:3.43	429	2.85	25.0	6.000	0.930	18.77	50.700	2.98	2	2.00	7.50	10.48
Delaware & Raritan	43	270	1:2.798	1:3.18	724	4.82	42.0	7.780	1.120	15.63	66.530	2.42	2	2.00	10.00	12.42
"	43	170	1:4.424	1:4.28	341	2.27	19.8	4.940	0.758	15.63	41.128	2.42	2	1.96	10.00	12.42
Penn. Delaware division	60	90	1:3.636	1:4.18	235	1.56	13.7	2.580	0.413	15.50	32.243	3.58	2	2.88	5.50	9.08
Chesapeake & Delaware	13½	300	1:2.515	1:2.80	1,071	7.14	67.0	7.420	1.033	14.00	89.453	2.98	2	2.59	10.00	12.98
"	13½	85	1:8.060	1:4.00	130	0.86	7.5	2.180	0.321	14.00	22.001	2.60	2	2.26	10.00	12.60

Transportation of Coal on Canals, etc.—Continued.

NAME OF ROUTE.	TRACTION OR RESISTANCE.						COST OF MOVEMENT—CENTS PER MILE.					COST TRANSPORTATION—MILLS PER TON PER MILE.				
													Reduced to a level.			
	Len. route in miles.	Burthen of boats.	Area boat to area canal.	Width boat to width canal.	Resistance in lbs.	No. horses required.	Cost of motive power —towing.	Cost of boat and furniture with interest on same.	Repairs of boat and furniture.	Expense of crew.	Total per mile.	Cost including detentions, lockages, &c.	Speed pr hour.	Cost on a level canal.	Tolls (1861).	Cost including detentions and tolls.
Chesapeake & Ohio	191	120	1:4.815	1:4.82	309	2.00	18.0	4.345	0.638	15.50	38.483	3.30	2	2.60	3.00	6.30
Penn. Juniata division	127	76	1:2.666	1:2.89	247	1.64	14.5	2.290	0.303	16.53	33.623	4.42	2	3.26	5.00	9.42
Union canal	77⅔	85	1:2.422	1:2.60	341	2.29	20.0	2.875	0.433	18.00	41.308	4.86	2	3.27	5.00	9.86
Average	......	120	1:3.527	1:3.37	353	2.34	20.6	4.105	0.566	18.28	43.227	4.04	2	2.82	4.82	8.86
Hudson river (sail)	160	450	1:6.500	1:4.50	5,054	33.50	0.0	18.040	2.260	34.91	55.612	1.23	5	0.61	....	1.23
" (canal boat)	160	120	1:6.500	1:4.50	1,300	8.60	16.5	2.200	0.220	8.22	27.140	2.26	5	1.82	....	2.26
Seneca lake	35	210	1:6.500	1:4.50	1,200	8.00	48.3	4.760	0.742	11.42	65.230	3.10	4	2.70	....	3.10
Delaware & Chesapeake bays	120	300	1:6.500	1:4.50	2,277	15.18	62.0	6.250	1.000	12.50	81.750	2.72	4	2.39	....	2.72
" " "	120	85	1:6.500	1:4.50	710	4.73	10.2	2.000	0.300	12.50	34.000	4.00	4	3.13	....	4.00
Ocean (sail)	530	450	1:6.500	1:4.50	7,240	48.20	0.0	15.026	2.216	29.08	46.324	1.03	6	0.51	....	1.03

The following statement shows the rates of toll charged upon each canal, as made up for the season from the published toll sheets, for a series of years:

Rates of Through Tolls on Anthracite Coal.

NAME OF CANAL.	THROUGH RATES FOR SEASON. Mills per ton per mile. 1861	1862	1863	1864	Remarks.
Erie canal	1	1	1	2	
Chenango	1	1	1	2	
Cayuga & Seneca	1	1	1	2	
Chemung	1	1	1	2	
Junction	10	10	10	10	Within combination.
do	25	25	25	25	Outside of combination.
North Branch	5	6	6	8½	Within combination.
do	25	25	25	25	Outside of combination.
Wyoming	3⅔	4 14-100	4½	5½	
West Branch & Susqueh'a	3⅔	4 14-100	4½	5⅓	
Penn. Eastern Division	3⅔	4 14-100	5	5	
Susquehanna & Tide Water	4⅔	4⅔	6	7	
Union canal	5	....	5½	6	
Delaware & Hudson	5¼	....	4½	23	
Lehigh canal	6	4 37-100	10	10	
Morris canal	5 81-100	....	......	13	
Penn. Delaware Division	5½	....	8	....	
Schuylkill	7½	....	13¼	18 2-10	
Delaware & Raritan	10	....	10	11 11-100	
Chesapeake & Delaware	10	10	10	18 51-100	
Chesapeake & Ohio	3	3	3	4 36-100	
Penn. Juniata Division	5	5	5	5	

Freight Charges on Coal Transported on Canals in 1861 *and* 1864.

FROM—TO—	NAME OF CANAL.	Length of Route.	RATES CHARGED, INCLUD'G TOLLS. Through Charge. 1861	Through Charge. 1864	Mills per Ton per Mile. 1861	Mills per Ton per Mile. 1864	Percentage of increase, '64 over '61.
Corning to Oswego	N. Y. S. canals.	160	$1 13	$2 50	7.06	15.62	121
do Buffalo	do	242	1 20	3 00	5.00	12.39	150
do Syracuse	do	122	93	1 60	7.62	13.11	72
do Troy	do	281	1 93	3 00	6.87	10.67	55
do Seneca Falls	do	79	60	1 25	7.59	15.82	108
Binghamton to Utica	do	97	1 10	2 75	11.34	28.35	150
Watkins to Troy	do	248	2 10	3 42	8.46	13.79	63
Elmira to Albany	do	278	1 96	3 00	7.06	10.79	53
Hawley to Rondout	Del. & Hudson	100	1 45 1-10	3 55⅝	14.51	35.56	145
M. Chunk to Jersey City	Morris canal	148	1 72	3 72	11.62	25.13	116
Cumberland to G'getown	Ches. & Ohio	191	1 62	3 25	8.50	17.01	100
Pt. Carbon to Philadel'a	Schuylkill	108	1 45	3 42	13.42	31.66	136
Average	....	......	....	....	9.09	19.16	110

Freight Charges on Coal Sea-borne from Tide Water Ports, Oct. 10th, 1861, and Oct. 20th, 1864.

	Distance in Miles.	Rates on Dist'ce.		Mills per Ton per Mile.	
		1861	1864	1861	1864
From Philadelphia & Reading RR., Richmond, Philadelphia, to—					
Portland, Maine, (sail)	620	$1 00	$2 75	1.61	4.43
Portsmouth, N. H., do	590	1 10	2 85	1.86	4.83
Newburyport, Mass., do	575	1 10		1.91	....
Boston, Mass., do	560	1 00	2 75	1.78	4.91
New Bedford, Mass., do	395	90	2 30	2.28	5.82
Newport, R. I., do	390	90	2 25	2.30	5.77
New London, Conn., do	375	90	2 25	2.40	6.00
Norwich, Conn., do	390	1 00	....	2.56	....
Tortugas, do	1,200	4 25	....	3.54	....
Cuba, do	1,270	4 25	....	3.34	....
New Haven, Conn., do	360	87½	2 30	2.43	6.38
Bridgeport, Conn., do	345	87½	2 30	2.53	6.66
New York, do	285	82½	2 00	2.89	7.02
Newark, N. J., do	287	82½	....	2.87	....
Albany, do	445	90	....	2.02	....
Troy, do	451	1 00	....	2.22	....
Philadelphia, Penn., do	3	12½	....	....	....
Fortress Monroe, do	277	1 00	....	3.61	....
Key West, do	1,230	4 25	....	3.45	....
Providence, R. I., do	405	90	2 25	2.22	5.50
Average	....	....	....	2.51	5.73
Incr'se of rates, 1864 over 1861 = 156 per cent.					
From N. J. Cent'l RR., Elizabethport, to—					
New York	12	35	$0 75	2.91	6.25
New Haven, Conn	96	47½	1 40	4.94	14.60
Boston, Mass	382	80	2 50	2.10	6.54
Albany, N. Y	172	50	....	2.90	....
Norwich, Conn	145	57½	1 50	3.96	10.34
Providence, R. I	200	60	1 80	3.00	9.00
Fall River, Mass	225	60	1 80	2.66	8.00
Newport, R. I	170	60	1 80	3.52	10.56
Taunton, Mass	225	75	1 90	3.33	8.44
Pawtucket, Mass	230	70	1 90	3.04	8.26
Newburyport, Mass	400	80	2 65	2.00	6.62
Portland, Maine	450	80	2 50	1.77	5.55
Troy, N. Y	178	50	....	2.80	....
Poughkeepsie	87	45	....	5.17	....
Hartford	167	75	....	4.49	....
New London	132	55	1 60	4.16	12.12
Derby, Conn	100	65	....	6.50	....
Average	....	....	....	3.48	8.85
Incr'se of rates, 1864 over 1861 = 154 per cent.					
July 6th, 1864. *From Balt. & Ohio RR., Locust Point, to—*					
Boston	770	....	4 12½	....	5.35
New York	490	....	3 00	....	6.12
New Haven	585	....	3 75	....	6.41
Philadelphia	440	....	1 50	....	(3.41)
Providence	620	....	4 00	....	6.45
Portland	830	....	4 12½	....	4.97
Pawtucket	630	....	4 25	....	6.74
Average	....	....	....	....	6.00

The following statement shows the average rates charged for towing coal boats and barges, by the Steam Towing Companies, on the Chesapeake and Delaware bays and rivers, also the Hudson river, for the years 1861 *and* 1864 *:*

BURTHEN OF BOATS.	MILLS PER TON PER MILE.							
	24 Miles.		120 Miles.		270 Miles.		160 Miles.	
	Havre de Grace to Ches. & Del. ca'l.		Bet. Philadelphia and Baltimore.		Philadelphia to Washington.		New York to Albany.	
	1861	1864	1861	1864	1863	1864	1861	1864
50 tons..........	3.33	5.83	3.66	10.80	11.11	14.81	1.37	1.53
60 "	2.77	4.86	3.05	9.72	9.56	12.46	1.37	1.53
70 "	2.38	4.16	2.61	8.93	8.46	11.42	1.37	1.53
80 "	2.60	4.16	2.43	8.33	7.63	10.00	1.37	1.53
85 "	2.41	4.41	2.26	8.09	7.30	9.47	1.37	1.53
90 "	2.77	4.63	2.30	7.08	7.00	9.05	1.37	1.53
120 "	2.43	5.55	2.42	6.94	5.80	7.25	1.37	1.53
175 "	3.00	6.43	2.13	6.06	4.56	5.54	1.37	1.53
200 "	2.29	6.66	2.13	5.83	4.16	5.09	1.37	1.53
250 "	2.25	7.00	2.10	7.16	3.70	4.44	1.37	1.53
300 "	2.22	7.22	2.08	6.73	3.30	4.00	1.37	1.53
134...Average.....	2.59	5.53	2.47	7.70	6.60	8.52	1.37	1.53

Cost of Mining Coal, or Value of Coal in Mines, including Profits.

	Selling Price.	Deduct Freight Charges.	Cost of Mining, including Profits.
At Pittston in 1859, as stated by O. W. Childs.....	$1 10	....	$1 10
Hawley do do do	1 98	$0 61	1 37
Rondout do do do	3 70	2 16	1 54
Syracuse do do do	3 00	1 96	1 04
Bingh'ton do do do	2 55	86	1 69
Towanda do do do	1 75	23	1 52
Average cost with profits	....	....	$1 37
Average cost in England....................	....	....	$1 20

The above average cost of mining ($1.37) was used in determining the actual cost of coal from the Schuylkill, Middle and Wyoming and Lackawanna anthracite coal fields, and also for bituminous coal, except the Cumberland coal, which was stated, in the Report of the President of the Baltimore and Hampshire Coal Company, to cost but 75 cents per ton in 1863, including all expenses connected with the mines.

Sketch of the Erie Canal, showing Cost of Transportation.

The following condensed sketch of the Erie canal, showing the gradual reduction in the cost of transportation, and the method pursued in the foregoing calculation, may be of interest to many not conversant with its general character as connected with this subject:

Erie Canal.—The construction of the Erie canal was commenced July 4th, 1817, and completed Oct. 26th, 1825, at a cost of $\$7,143,789\frac{86}{100} = \$19,255\frac{1}{2}$ per mile. The dimensions were as follows: Width at surface, 40 feet, at bottom, 28 feet, and 4 feet depth. The locks were 90 feet in length between quoins, 15 feet wide. The average burthen of boats used was 50 tons. The length of canal before its enlargement was 362 miles from Albany to Buffalo.

The cost of transportation in 1830 (the earliest record preserved) was for tolls $2\frac{8}{10}$ cents, and for tolls and freight $5\frac{1}{2}$ cents per ton per mile, from Albany to Buffalo; and from Buffalo to Albany, the tolls were about $1\frac{1}{2}$ cents, and tolls and freight $2\frac{1}{2}$ cents per ton per mile; making an average upon the tonnage to and from tide water (which was 5 to 1) = 3 cents per ton per mile, including tolls. The *enlargement of the Erie canal* was authorized May 11th, 1835; and accompanying the estimate of its probable cost, was one showing, that by the proposed enlargement the cost of transportation would be cheapened 50 per cent.

The cost of transportation in 1835 was, *from* tide water, for tolls $1\frac{81}{100}$ cents and for tolls and freight $4\frac{4}{10}$ cents per ton per mile; and *to* tide water, for tolls 9 mills, and for tolls and freight $1\frac{3}{4}$ cents; making the average cost upon the tonnage to and from tide water (which was about $5\frac{3}{4}$ to 1) $2\frac{12}{100}$ cents per ton per mile, including tolls.

The enlargement was practically completed in 1859, but the construction account was not closed until April 10th, 1862. The total cost of construction, including the original canal, was $39,152,640, and including land damages and interest on loans, $52,666,724. The present size of this canal is 70 feet surface, 56 feet at bottom and 7 feet depth, and $350\frac{1}{2}$ miles long. The locks are 110 feet in length between quoins, and 18 feet wide in the clear. The average burthen of boats now used is 210 tons.

The cost of transportation in 1862 averaged *from* tide water, for olls 4 mills, and for tolls and freight $7\frac{1}{10}$ mills per ton per mile;

and *to* tide water, for tolls 6 mills, and for tolls and freight $1\frac{2}{01}$ cents per ton per mile ; making an average upon the tonnage to and from tide water (which was as 8 to 1) $= 1\frac{12}{100}$ cents per ton per mile = a reduction of $50\frac{1}{2}$ per cent from 1835.

The aggregate of the carrier's charges in 1862 averaged $5\frac{68}{100}$ mills, and the tolls $5\frac{52}{100}$ mills per ton per mile. The actual cost of movement, calculated upon the method adopted in this report, is as follows :

Expense of crew (1 captain at $60 per month, 2 hands, $45 each, 1 cook, $30 per month) = $6 per day, by 8½ days....................	$51 00
Cost of boat and furniture, with interest for 10 years, divided into 2,300 days = total per day, $2.50, by 8½ days, the time of passage.	21 25
Repairs of boat, 25 per cent of cost = 38 cents per day	3 23
Towing, 25 cents per mile, by 350½ miles..........................	87 62
Total cost of passage....................................	$163 10

Actual cost, including lockage, per ton per mile, $\left(\frac{163.10}{210 \times 350\frac{1}{2}}\right) = 2$ 21–100 mills.

do reduced to a level, $\left(\frac{(655+350\frac{1}{2}) \times 2.21}{11.37}\right)$.........$=1$ 9–10 do

APPENDIX C.

LENGTH, DIMENSIONS, COST OF TRANSPORTATION ON RAILROADS AND CANALS OF NEW YORK AND PENNSYLVANIA.

NEW YORK STATE RAILROADS FOR 1863.

NAME OF ROAD.	Len. of road in miles.	Length of road laid in miles.	Length of double track including sidings, in miles.	Length of branches owned by the comp'y laid, in miles.	Length of double track on same, in miles.	Gauge.
Albany and Kenwood*	3	......	......	......	......	4.71
Albany and Susquehanna	140	35	1	......	......	6.00
Albany and Vermont	12	12	......	......	......	4.71
Albany and West Stockbridge	38	38	44	......	......	4.71
Atlantic and Gt. Western in N. Y.	48.89	48.89	3.07	......	......	4.71
Avon, Geneseo and Mt. Morris	15.50	15.50	50	......	......	4.71
Blossburg and Corning	14.83	14.83	4.26	......	......	6.00
Broadway Railroad of Brooklyn	5.38	5.38	5.38	......	......	......
Brooklyn, Bath and Coney Island	6.50	4	......	......	......	......
Brooklyn Central and Jamaica	14.50	14.50	9.50	......	......	......
Brooklyn City	30.21	28.31	26.96	91	......	......
Brooklyn City and Newtown	9.50	5.25	5.25	......	......	......
Brooklyn City and Ridgewood	25	10	......	......	......	......
Buffalo and Allegany Valley*	30	......	......	......	......	......
Buffalo, Bradford and Pittsburg*	100	12	......	......	......	......
Buffalo, New York and Erie	142	142	13	§18.25	2.75	6.00
Buffalo and State Line	88	88	17	......	......	4.83
Cayuga and Susquehanna	34.61	34.61	3.49	......	......	6.00
Central Park, North and East River	22	......	8	......	......	......
Chemung	17.36	17.36	2.06	......	......	6.00
Coney Island and Brooklyn	10.50	10.50	4.50	25	......	......
East and North River*	6	......	......	......	......	......
Eighth Avenue	10	......	7.33	......	......	......
Erie Railway	459	459	320	‖165	16	6.00
Erie and New York City*	25	......	......	......	......	6.00
Forty-second St. & Grand St. Ferry	8	7	4	......	......	......
Hudson and Boston	17.33	17.33	3	......	......	4.71
Hudson River	144	144	128.25	......	......	4.71
Lake Ontario, Auburn and N. Y.*	73.84	......	......	......	......	......
Long Island	98	98	......	2.50	......	......
New York Central	555.88	555.88	398.01	258.13	2	4.71
New York and Harlem	130.75	130.75	31.13	2.12	......	4.71
New York and New Haven	62.25	62.25	63.82	......	......	4.71
Ninth Avenue	13	......	6	......	......	......
Northern	118	118	17.75	3.75	......	......
Oswego and Rome	28	......	......	......	......	......
Oswego and Syracuse	35.91	35.91	2.21	......	......	4.71
Port Morris and Westchester*	11	......	......	......	......	......
Rensselaer and Saratoga	25.22	25.22	2.51	......	......	4.71
Rochester City and Brighton	10	6.60	90	......	......	......
Rochester and Genesee Valley	18.45	18.45	1.25	......	......	6.00
Rome, Watertown and Ogdensburgh	189.63	189.63	14.78	48.52	3.43	4.71
Saratoga and Schenectady	21	21	1.57	......	......	4.71

NAME OF ROAD.	Len. of road in miles.	Length of road laid, in miles.	Length of double track including sidings, in miles.	Length of branches owned by the comp'y laid, in miles.	Length of double track on same, in miles.	Gauge.
Saratoga and Whitehall	40.86	40.86	3.87	6.66	......	4,71
Second Avenue	8	8	8	....	......	......
Sixth Avenue	4	4	4.37	....	......	......
Sodus Point and Southern*	35	....	....	....	......	......
Staten Island	13	13	33	....	......	......
Syracuse, Binghamton and New York	81	81	8	....	......	6.00
Third Avenue	8	8	8.50	....	......	......
Third Avenue and Fordham*	5	....	....	....	......	......
Troy and Bennington	5.38	5.38	38	....	......	4.71
Troy and Boston	34.91	34.91	3.48	....	......	4.71
Troy and Cohoes*	4.50	3	....	....	......	......
Troy and Greenbush	6	6	04	....	......	4.71
Troy and Rutland	18.50	18.50	1	....	......	4.71
Troy Union	2.14	2.14	2.14	....	......	4.71
Utica and Black River	86.25	34.94	2.59	....	......	4.71
Utica City	....	2	....	....	......	......
Van Brunt St. and Erie Basin	1.25	1.25	25	....	......	......
Warwick Valley	10.33	10.33	....	....	......	......
Westchester*	4	....	....	....	......	......
West Shore*	4	....	....	....	......	......
	3,240.16	2,698.46	1.193.43	506.09	24.18	......
Excluding City roads	3,022.82	2,580.67	1,094.49	504.93	24.18	......

* Road not in operation. † Owned by lessees of road.

§ Branches operated by the company. ‖ This includes branches leased by the company.

The total cost of all the railroads in the State of New York, including equipment, $148,040,643. Cost, exclusive of city railroads, $136,850,299. The total number of tons of freight transported in 1863=7,197,804. Total number of tons carried one mile=994,039,502.

Deductions from the reports of several of the principal companies, showing, 1st. Average sum received per ton per mile on freight. 2d. Average cost per ton per mile transporting freight. 3d. Percentage of transportation expenses to gross earnings.

1862.

NAME OF ROAD.	AVERAGE PER TON PER MILE.		Per cent of transportation expense on gross earnings.
	Received for transporting.	Cost of transporting.	
	Cents.	Cents.	
Buffalo, New York and Erie	2.03	1.22	66.54
Buffalo and State Line	2.78	1.45	51.33
Erie Railway	1.89	.95	61.93
Hudson River	2.26	1.20	51.89
Long Island	3.66	2.29	62.13
New York Central	2.23	1.39	59.93
New York and Harlem	3.74	2.82	60.43
New York and New Haven	4.54	3.10	54.39
Northern	2.05	1.19	64.11
Oswego and Syracuse	3.49	1.72	44.71
Rome, Watertown and Ogdensburgh	3.12	1.97	49.79
Saratoga and Whitehall	3.11	1.96	64.26
Syracuse, Binghamton and New York	1.26	.41	38.49

1863.

NAME OF ROAD.	AVERAGE PER TON PER MILE.		Per cent of transportation expense on gross earnings.
	Received for transporting.	Cost of transporting.	
	Cents.	Cents.	
Buffalo, New York and Erie	1.95	1.31	71.28
Buffalo and State Line	2.78	1.40	62.43
Erie Railway	2.09	.95	61.51
Hudson River	2.74	1.33	48.81
New York Central	2.38	1.55	62.79
New York and Harlem	3.88	3.27	60.72
New York and New Haven	4.31	3.07	57.88
Northern	2.29	1.28	73.17
Oswego and Syracuse	3.61	1.89	48.96
Rensselaer and Saratoga	5.25	3.52	65
Rome, Watertown and Ogdensburgh	2.92	2.14	52.37
Saratoga and Whitehall	2.83	1.80	62.52
Syracuse, Binghamton and New York	1.37	.55	42.89

Statement showing the Tons of Total Movement and Mileage on the New York Central and New York and Erie Railroads, and Freight on the same, and the Average Cost per Ton per Mile.

YEAR.	New York Central Railroad.			New York and Erie Railroad.		
	Tons moved one mile.	Receipts for freight.	Per ton per mile.	Tons moved. one mile.	Receipts for freight.	Per ton per mile.
			Cents.			Cents.
1853........	54,701,350	$1,838,830 00	3.36	101,626,522	$2,537,214 00	2.49
1854........	81,168,080	2,479,820 00	3.05	130,808,034	3,369,590 00	2.57
1855........	99,605,836	3,189,603 00	3.20	150,673,998	3,653,002 00	2.43
1856........	145,733,678	4,328,041 00	2.97	183,458,046	4,545,782 00	2.48
1857........	145,873,776	4,559,276 00	3.13	167,100,850	4,097,610 00	2.45
1858........	142,691,178	2,700,270 00	2.59	165,895,635	3,843,311 00	2.32
1859........	157,136,000	3,337,148 00	2.13	147,127,039	3,195,870 00	2.17
1860........	199,231,392	4,095,934 00	2.06	214,084,395	3,946,410 00	1.84
1861........	237,392,974	4,664,449 00	1.96	251,350,127	4,351,464 00	1.73
1862........	296,963,492	6,607,330 96	2.22	351,092,285	6,642,914 68	1.89
1863........	312,195,796	7,498,505 95	2.38	403,670,861	8,175,097 12	2.09

New York State Canals.

Dimensions of the New York State canals, with cost of each per mile, September 30th, 1862.

NAME OF CANAL.	When authorized.	When completed.	Length in miles.	Size of Canal. Width on surface	Size of Canal. Width on bott'm.	Size of Canal. Depth of water.	No. and Size Locks. Number of locks.	No. and Size Locks. Length between quoins.	No. and Size Locks. Width in clear.	Cost pr mile, canal improvement and land damages.	Feet of lockage.	Average burthen boats.	Maximum burthen of boats.
Erie canal	1817	1825	363	40	28	4	83	90	15	$19,679 87	675½	70	76
" enlargement same	1835	1862	350½	70	56	7	71	110	18	90,824 65	655	210	240
Oswego canal	1825	1828	38	40	24	4	18	90	15	14,880 00	155	70	76
" enlargement same	1847	1862	38	70	56	7	18	110	18	66,105 00	155	210	240
Cayuga & Seneca canal	1825	1828	21	40	24	4	10	90	15	10,190 50	83½	70	76
" enlargement same	1836	1862	23	70	56	7	11	110	18	49,282 00	83½	210	240
Champlain canal	1817	1822	66	50	35	5	20	100	18	21,556 32	166¼	80	85
" Glens Falls feeder	1822	1837	12	50	35	5	12	100	18		132	80	85
" pond above Troy dam	1822	1837	3	......	......	......	1	....	..				
Black River canal and feeder	1836	1849	50	42	26	4	109	90	15	60,000 00	1,082	70	76
" improvement	1849	1861	42	......	......	......	1	110	18	3,707 00	....	70	76
Genesee Valley canal	1826	1861	124¾	42	26	4	112	90	15	45,305 00	1,045¾	70	76
Chenango canal	1833	1836	97	40	24	4	116	90	15	25,684 00	1,015½	71	76
Chemung canal and feeder	1829	1831	39	42	26	4½	53	90	15	26,983 00	421	85	90
Oneida River improvement	1839	1850	20	80	60	4½	2	120	30	5,397 00	6¼	70	76
Oneida Lake canal	1832	1836	7	40	24	4	7	90	15	7,143 00	60¼	70	76
Baldwinsville canal and Seneca towing path	1838	1839	5¾	40	24	4	1	90	15	2,884 00	....	70	76
Crooked Lake canal	1829	1833	8	42	26	4	27	90	15	38,262 00	278	70	76

Total Cost of Construction and Repairs of the New York State Canals, including Land Damages and Engineering, September 30, 1862.

NAME OF CANAL.	Total paid for repairs.	Original cost of canals.	Cost with improvem't and land damages.	Cost with interest on loans.
Erie canal..................	$10,995,333 52	$7,143,789 86	$38,977,831 16	$52,491,915 74
Oswego canal............	1,244,442 48	565,437 35	3,077,429 57	3,612,825 11
Cayuga and Seneca canal.	486,582 77	214,000 00	1,347,149 26	1,584,554 09
Champlain c'l and feeder.	2,016,895 00	921,011 13	1,746,062 63	2,647,002 34
Black river do	181,887 70	2,954,848 64	3,157,296 38	4,239,566 75
Genesee valley canal.....	612,336 01	5,342,753 20	5,663,183 99	9,408,896 19
Chenango canal	506,681 79	2,316,186 00	2,491,351 68	3,754,143 80
Chemung canal and feeder	756,198 18	314,395 00	1,052,343 51	1,623,693 42
Oneida river improvement.	23,908 41	79,346 00	107,959 55	173,348 54
Oneida lake canal.........	79,406 49	*78,829 85	50,000 00	74,916 09
Seneca river towing path and Balwinsvillle canal.	9,662 03	14,846 00	16,585 13	16,585 13
Crooked lake canal.......	127,817 37	156,776 00	306,103 28	418,890 96
Totals.............	$17,041,151 75	$20,102,237 03	$57,993,296 14	$80,046,338 16

* This amount was paid by company, as reported by the petitioners in their application to the State to purchase the same. See Senate Document No. 16, 1837. They reported the cost of the canal at $64,886.37, and the feeder $13,938.48.

The following Statement shows the Net Gain and Loss upon each and all the New York State Canals, from 1817 *to September* 30, 1862.

NAME OF CANAL.	Total amount tolls rec'd from completion of canal, to September 30, 1862.	Total expenditures for repairs, collectors, inspectors and weighmasters.	Surplus and deficiences.
Erie canal	$71,783,670 65	$12,518,860 03	$59,264,810 62*
Oswego canal..................	2,022,365 73	1,450,403 37	571,962 36*
Cayuga and Seneca canal........	694,280 27	557,934 64	136,345 63*
Camplain canal and feeder......	4,127,646 60	2,296,358 93	1,831,287 67*
Black river canal..............	71,536 38	310,233 39	238,697 01†
Genessee valley canal..........	538,050 77	849,284 96	311,234 19†
Chenango canal................	509,374 78	690,471 40	181,096 62†
Chemung canal and feeder......	375,819 64	935,996 26	560,176 62†
Crooked lake canal	40,216 01	185,338 03	145,122 02†
Oneida lake canal..............	65,130 30	113,024 28	47,893 98†
Oneida river improvement......	191,139 08	24,730 00	166,409 08*
Balwinsville canal and Seneca towing path.................	1,201 49	11,185 45	9,983 96†
	$80,420,431 70	$19,943,820 74	$60,476,610 96*

NOTE.—The sign * is for surplus, and † for deficiencies.

Cost of Transportation.

Statement showing the tons of total movement for nine years, the tolls paid, freight paid to carrier, and the average cost per ton per mile.

New York State Canals.

YEAR.	Tons moved one mile.	Amount of tolls.	Amount of tolls and freight.	COST PER TON PER MILE.	
				For tolls.	For tolls and freight.
1853......	700,389,933	$3,204,718 00	$7,393,884 00	4.57 mills.	1.05 cents.
1854......	668,559,044	2,773,566 00	5,782,855 00	4.15 "	0.865 "
1855......	619,170,651	2,085,077 00	5,841,420 00	3.36 "	0.943 "
1856......	592,009,603	2,748,212 00	6,573,225 00	4.22 "	1.11 "
1857......	484,750,864	2,045,641 00	3,876,000 00	4.21 "	0.80 "
1858......	564,842,095	2,110,754 00	4,502,437 00	3.71 "	0.80 "
1859......	544,309,072	1,723,945 00	3,665,806 00	3.16 "	0.677 "
1860......	809,524,596	3,009,597 00	8,049,450 00	3.72 "	1.00 "
1861......	863,623,507	3,908,785 00	9,369,378 00	4.53 "	1.08 "
1862......	1,123,548,430	5,188,943 00	10,780,431 00	4.62 "	0.96 "
1863......	1,034,130,023	4,645,207 00	9,065,005 00	4.50 "	0.87 "

We find, from the foregoing statement, that the carrier's charge for the year 1862, upon all the canals, amounts *to five mills per ton per mile*, while the tolls amount to $4\frac{62}{100}$ mills.

General view of the progress of the trade of the Erie canal, with the cost of transportation, from 1824 *to* 1862 *inclusive.*

YEAR.	Tons going from tide water.	Tons arriving at tide water.	Total lockages at Junction and Alexander's lock.		No. boats arrived at and cleared from N. York, Albany and Troy.	COST OF TRANSPORTATION PER TON.			
						Albany to Buffalo.		Buffalo to Albany.	
						For tolls	For tolls and freight.	For tolls	For tolls and freight.
1824	....	....	6,166		8,760	....	....	....	....
1825	....	....	10,985		13,110	....	....	....	....
1826	35,435	....	15,156		....	....	....	....	....
1827	....	....	13,004		....	....	....	....	....
1828	56,797	....	14,579		23,662	....	....	....	....
1829	52,621	....	12,619		21,490	....	....	....	....
1830	70,154	....	14,674		23,874	$10 22	$20 00	$5 11	$9 07
1831	86,945	....	16,284		26,882	10 22	19 80	5 11	8 89
1832	....	....	18,601	Alexander's lock.	25,826	10 22	20 00	5 11	9 26
1833	119,468	....	20,649		31,460	8 76	14 80	3 65	8 15
1834	114,608	....	22,911		32,438	6 57	16 40	3 28	7 68
1835	128,910	753,191	25,798		36,690	6 57	16 00	3 28	6 29
1836	133,796	696,347	25,516		34,190	6 57	21 00	3 28	7 13
1837	122,130	611,781	21,055		31,082	6 57	18 60	3 28	7 50
1838	142,802	640,481	25,962		32,120	6 57	17 80	3 28	6 76
1839	142,035	602,128	24,234		31,882	6 57	17 80	3 28	6 94
1840	120,586	689,012	26,987		30,456	6 57	16 60	3 28	7 50
1841	162,715	774,334	30,320		33,782	6 57	12 20	3 28	6 57

YEAR.	Tons going from tide water.	Tons arriving at tide water.	Total lockages at Junction and Alexander's lock.	No. boats arrived at and cleared from N. York, Albany and Troy.	Cost of Transportation per Ton. Albany to Buffalo. For tolls	Albany to Buffalo. For tolls and freight.	Buffalo to Albany. For tolls	Buffalo to Albany. For tolls and freight.
1842	123,294	666,626	31,682	32,840	$6 57	$13 20	$3 28	$6 02
1843	143,595	836,861	31,348	32,826	6 57	11 20	3 28	5 56
1844	176,737	1,019,094	38,313	38,786	6 57	13 00	3 28	5 56
1845	195,000	1,204,943	39,094	40,090	6 57	9 60	3 28	6 57
1846	213,295	1,362,319	43,202	42,936	4 80	8 00	2 92	5 92
1847	288,261	1,744,283	54,131	51,634	4 80	7 80	2 92	7 13
1848	329,557	1,437,905	44,076	43,018	4 80	7 80	2 92	5 37
1849	315,550	1,579,946	47,315	46,520	4 80	7 80	2 92	5 18
1850	418,370	2,033,833	51,245	46,880	4 80	7 20	2 92	5 48
1851	467,961	1,977,151	54,257	53,316	4 40	6 20	2 19	4 71
1852	521,527	2,234,822	55,050	55,166	2 92	5 20	2 19	4 90
1853	584,141	2,505,797	56,280	55,732	2 92	5 60	2 19	5 18
1854	531,831	2,223,743	50,674	48,825	2 92	5 00	2 19	4 81
1855	504,696	1,895,593	44,401	41,110	2 92	5 00	2 19	4 81
1856	573,233	2,123,469	47,096	44,628	2 92	5 40	2 19	5 56
1857	340,170	1,617,187	31,472	35,506	2 92	4 80	2 19	4 26
1858	287,073	1,985,142	32,386	33,118	1 46	2 80	1 46	3 14
1859	317,459	2,121,672	29,514	29,788	70	2 40	1 41	2 87
1860	373,735	2,854,877	41,598	40,608	1 40	2 40	1 41	3 88
1861	340,736	2,980,144	37,786	39,526	1 40	2 20	1 76	4 26
1862	417,623	3,402,709	42,866	41,690	1 40	2 50	2 11	4 22
1863	456,800	3,274,727	40,887	39,386	1 40	2 50	2 11	4 17

Statement of total length navigable miles of canals, feeders and rivers, with lakes, connected artificially by canals, in New York State.

	Miles.
Total length of navigable canals and feeders....................	886½
Length Hudson river, New York to Waterford....................	160
Lake Champlain, Whitehall to Rouse's Point....................	111
Oneida lake....................	22
Cayuga lake....................	39
Seneca lake....................	35
Crooked lake....................	19
	1,272½

PENNSYLVANIA RAILROADS, 1862.

NAME.	From	To	Distance.	Gauge.
Allegheny Valley	Pittsburg	Kittaning	45	4.8½
Barclay Railroad and Coal Company	Mines	Towanda	16	4.8½
Beaver Meadow	Mauch Chunk	Honeybrook	24½	4.8½
Bedford	Bedford	Hopewell	19	4.8½
Bellefonte and Snow Shoe	Bellefonte	Snow Shoe	13½	4.8½
Catasauque and Fogelsville Railroad	Catasauque	Fogelsville	....	....
Catawissa	Junction North of Tamaqua	Milton	65	4.8½
Chestnut Hill	Germantown	Chestnut Hill	4½	4.8½
Chester Valley	Bridgeport	Downingtown	21½	4.8½
Cleveland, Painsville and Ashtabula	Cleveland, Ohio	Erie	95½	4.10
	Cleveland	Wellsville	98 17-100	
Cleveland and Pittsburg	Bayard	New Philadelphia	31½	4.10
	Rochester	Bell Air River Line	68½	
Cumberland Valley	Harrisburg	Chambersburg	52	4.8½
Delaware, Lackawanna and Western	Great Bend	Delaware River	113	6.0
Delaware and Hudson Canal and Railroad	Honesdale	Providence	30	4.8
Doylestown Branch	Doylestown	Junction N. Penna. Railroad	10	....
East Brandywine and Waynesburg	Downingtown	Waynesburg	17½	4.8½
East Mahony	Catawissa Railroad	Mines	13	4.8½
East Pennsylvania	Reading	Allentown	35 8-10	4.8½
Elmira and Williamsport	Williamsport	Elmira	78	4.8½
Erie and North East	Erie	State Line	18½	4.10
Fayette County	Uniontown	Connelsville	12 1-16	4.8½
Franklin	Chambersburg	Hagerstown	22	4.8½
Gettysburg	Hanover	Gettysburg	17	4.8½
Hanover Branch	Hanover Junction	Junction N. Central	12½	4.8½
Harrisburg, Portsmouth, Mount Joy, etc.	Harrisburg	Dillerville	54	4.8½
Hazleton Coal Company	Penn Haven	Hazleton	15	4.8½
Hempfield	Wheeling, Va.	Washington	32	4.8½
Huntingdon and Broad Top Mountain	Huntingdon	Hopewell	31	4.8½
Ironton	Lehigh Valley Railroad	Ironton	9 68.100	4.8½
Jamestown and Franklin	Jamestown	Franklin	....	....
Junction	Belmont	Gray Ferry	4 61-100	4.8½
Lackawanna	Jessup	Del. L. & W. R. R.	....	6.

Lackawanna and Bloomsburg	Scranton	Northumberland	80	17m. 6.0 4.8¼
Lebanon Valley	Reading	Harrisburg	54	4.8¼
Lehigh and Luzerne	Hasleton	Milnesville	9½	4.8¼
Lehigh and Susquehanna	Wilkesbarre	White's Haven	20	4.8¼
Lehigh Valley Railroad and Coal Company	Mauch Chunk	Easton	46	4.8¼
Littlestown	Hanover	Littlestown	7½	4.8¼
Little Saw Mill Run	Ohio River	Mines	3	4.8¼
Little Schuylkill	Port Clinton	Catawissa Railroad	28¾	4.8¼
Little Schuylkill Navigation and Coal Company	Port Clinton	Foot of Broad Mountain	28	4.8¼
Lock Haven and Tyrone	Lock Haven	Tyrone City	54	4.8¼
Lorberry Creek	Swatara and Union Railroad	Mines	5	4.8¼
Lykens Valley Railroad and Coal Company	Wiconisco	Millersburg	16	4.8¼
Mahoney and Broad Mountain	New Castle		31	4.8¼
Mauch Chunk and Summit Hill	Summit Hill	Mauch Chunk	8	4.8¼
McCauley Mountain	McCauley Mountain	Catawissa Railroad	6	4.8¼
Mill Creek and Mine Hill Navigation	Palo Alto	Wolf Creek	4	4.8¼
Mine Hill and Schuylkill Haven	Schuylkill Haven	Locust Gap Junction	28 6–10	4.8¼
Mount Carbon	Mount Carbon	Mine Hill	3½ to 4	4.8¼
Mount Carbon and Port Carbon	Mount Carbon	Port Carbon	2½	4.8¼
New York and Erie	Piermont	Dunkirk	446	6.00
Nesquehoning Valley	Mauch Chunk	Hometown	13	4.8¼
Northern Central	Baltimore	Sunbury in Penna. 103	138	4.8¼
North Lebanon	Cornwall	Union Canal	7½	4.8¼
North Pennsylvania	Philadelphia	Bethlehem	55	4.
Oil Creek	Corry	Franklin	54	
Pennsylvania	Philadelphia	Pittsburg	355 66–100	4.8¼
Pennsylvania Coal Company and Railroad	Hawley	Port Griffith	47	4.3–12
Penn Haven and White Haven	Penn Haven	White Haven	16	4.8¼
Philadelphia and Baltimore Central	Intersection W. C. & P. R. R.	Intersection N. Central	79	4.8¼
Philadelphia, Germantown and Norristown	Norristown	Philadelphia	17	4.8¼
Philadelphia and Reading	Philadelphia	Pottsville	93	4.8¼
Philadelphia and Sunbury	Sunbury	Harbor of Erie	288	4.8¼
Philadelphia and Trenton	Philadelphia	Morrisville	28 2–10	4.10
Philadelphia, Wilmington and Baltimore	Philadelphia	To Delaware State Line	17	4.8¼
Pittsburg and Connelsville	Pittsburg	Connelsville	50	4.8¼
Pittsburg, Fort Wayne and Chicago	Pittsburg	Chicago, in Penna. 51½	467½	4.10
Quakake	Beaver Meadow Railroad	Catawissa Railroad	14	4.8¼
Reading and Columbia	Sinking Spring	Columbia	39	4.8¼
Schuylkill and Susquehanna	Rockville	Auburn	54	4.8¼
Schuylkill Valley Navigation	Port Carbon	Tuscarora	9½	4.8¼
Shamokin Valley and Pottsville	Sunbury	Mount Carmel	23	4.8¼

Pennsylvania Railroads, 1862—Continued.

NAME.	From	To	Distance.	Gauge.
Strasburg	Strasburg	Lemon Place	4½	4.8½
Swatara	Junction Union Canal	Donaldson	6	2.8½
Tioga	Lainesville	Morris Run	29 6–10	6.0
Trevorton Coal and Railroad Company	Trevorton	Pennsylvania Canal	13½	4.8½
West Chester	West Chester	Junction Penna. Railroad	9	4.8½
West Chester and Philadelphia	Philadelphia	West Chester	26 38–100	4.8½
Wrightsville, York and Gettysburg	Wrightsville	York	13	4.8½

The total length of railroads in Pennsylvania, in 1863, was 3,330 miles of main track, constructed at an expense of $162,324,-814, including equipment, etc. The city railroads of Philadelphia are equal to 148 miles in length, and cost $4,000,000 in 1861. There was transported over the railroads in Pennsylvania in 1863, 23,932,248 tons of freight, including 14,351,174 tons of anthracite coal, 2,038,693 of bituminous, and nearly 600,000 tons of iron.

Pennsylvania Canals, 1862.

NAME.	From	To	Distance.
Penn. Canal, Delaware Division	Easton	Bristol	60
do Eastern do	Columbia	Duncan's Island	46
do Juniata do	Duncan's Island	Hollidaysburg	127
do Western do	Johnstown	Pittsburg	104
do Susqueh'a do	Duncan's Island	Northumberland	41
do West Br'ch do	Northumberland	Farrandsville	76
do North B'ch do	do	New York State Line	167
do Bald Eagle Side Cut	Lock Haven	Bald Eagle Creek	4
do Lewisburg do	West Br. Division	Lewisburg	½
do Lackawanna Feeder	North Br. do	Lackawanna River	¼
do Allegheny Branch	Western do	Allegheny City	½
do Johnstown Feeder	do do		1½
do Raystown Branch	Juniata do		1
do Erie Extension	Chenango	Erie	106
do Conneaut Line	Conneaut Lake	Erie	11½
do French Creek Feeder	Above Meadville	Junction, Erie Extension	27
do Beaver Division	Beaver	Head slack water Navigat'n	30¼
do Bald Eagle & Sp'g Ck	Bald Eagle Creek	Bellefonte	15
do Franklin Line	Below Meadville	Franklin	22½
do Mahaning	Near New Castle	Ohio State Line	8
Lehigh Navigation			
do Lower Division	Easton	Mauch Chunk	46
do Middle do	Mauch Chunk	White's Haven	26
Lehigh Upper Division	White's Haven	Stoddardsville	12
Schuylkill Navigation	Port Carbon	Philadelphia	108
Union Canal	Reading	Middletown	82
do Feeder	Pinegrove	Union Canal	22
Conestoga Navigation	Lancaster	Safe Harbor	18
Codorous do	York	Susquehanna	11
Susquehanna and Tide Water	Wrightsville	Havre-de-Grace	45
Wiconisco Feeder	Millersburg	Clark's Ferry	12
Delaware and Hudson	Honesdale	Delaware River	25
Monongahela Navigation	Pittsburg	New Geneva	82
Youghiogheny	McKeesport	West Newton	18

The total length of the canals of Pennsylvania 1,047 miles.

New Jersey Railroads, 1862.

NAME.	From	To	Distance.
Burlington and Mount Holly	Burlington	Mt. Molly	7.12
Belvidere, Delaware	Belvidere	Trenton	64.21
Camden and Amboy	Camden	South Amboy	92.37
do Atlantic	do	Atlantic City	60.23
Central	Easton	Elizabethport	63.30
Hackensack and New York	Hackensack		4½
Millville and Glassboro'	Millville	Glassboro'	22.30
Jobstown B'nch, Camden & Amboy RR.	Craft's Creek	Jobstown	13
Freehold and Jamesburg	Freehold	Jamesburg	11½

New Jersey Railroads, 1862—Continued.

NAME.	From	To	Distance.
Flemington	Flemington	Lambertville	12
Milstone and New Brunswick	Millstone	New Brunswick	6.63
Morris and Essex	Newark	Hacketstown	52.52
Newark and Bloomfield	do	Bloomfield	6
Long Dock and Tunnel			2.88
Northern	Piermont	Jersey City	21.27
Trenton B'nch, Camden & Amboy RR.	Trenton	Bordentown	3
New Jersey RR. & Transportation Co.	Jersey City	New Brunswick	33 8-10
Patterson and Hudson River	Patterson	Hudson River	14
do Ramapo	do	Ramapo	15.12
Sussex	Newton	Junction Morris & Essex	12
Warren	New Hampton	Columbia	24
West Jersey	Camden	Bridgeton	28¼
Orange and Newark	Orange	Newark	3¼
Trenton and New Brunswick	Trenton	New Brunswick	27

New Jersey Canals, 1862.

NAME.	From	To	L'gth.	Lockage.	Size.
Delaware and Raritan	Bordentown	New Brunswick	43	116	75x47x7
do do Feeder.	Delaware River.	Canal	23	4	
Morris Canal	Easton	Jersey City	102	1,674	82x20x4
Salem	Salem Creek	Delaware River	4	.....	

Delaware Canals.

Chesapeake and Delaware	Delaware City	Chesapeake Bay	18.63	4	66x10

Maryland Canals.

Chesap'ke and Ohio	Georgetown	Cumberland	191	....	
do Wash'ton Br.		Potomac River	1¼	....	
Alexandria	Georgetown	Alexandria	7¼	....	
Maryland			17	....	
Tide Water Canal	Wrightsv'le, Pa.	Havre-de-Grace	45	233	

Anthracite Blast Furnaces of the United States.

(Key to the figures on the General Coal and Iron Map of Pennsylvania.)

Number.	NAME.	Locality.	Sizes.	Product.
1 & 2	Berkshire Anthracite Steam Iron Works	Berkshire Co., Mass	12x32, 16x41	1855, 4,612½
3	Stockbridge " Water "	" "	10x	7 tons a day.
4	Sharon Station Anthracite Steam Furnace	Corkenstown, New York	10x32	
5	Bull Falls " Water "	Litchfield Co., Conn	9½x34	8 tons a day.
6 & 7	Port Henry " Furnace	Essex Co., New York	18½x42, 16x46	1856, 9,730
8	Siscoe " Steam Furnace	Westport, "	18x42	1856, 4,200
9	Fort Edward " Water "	Fort Edward, "	18½x50	
10	Clinton " Steam "	9 miles N. of Utica, N. Y.	......	
11, 12	Hudson " " "	Hudson, New York	6x45	1855, 14,424
13, 14	Poughkeepsie " " "	Poughkeepsie	13½x43, 15x46	1856, 4,928
15	Napanock " Water "	25 miles S. W. Kingston	9x30	1856, 1,700
16, 5	Croton Patent " Furnace	Croton Landing	......	
16	Peekskill " Steam Furnace	Peekskill	16x44	12 tons a day.
17	Greenwood Furnaces (one charcoal)	Greenwood Station	18x54	1855, 5,000
18	Manhattan Anthracite Steam Furnace	Manhattanville	11x40	1855, 4,600
19	Boonton " Water "	Boonton, New Jersey	14x40	1857, 6,574½
19, 5	Stanhope " Steam and Water Furnace	Stanhope, "	11x6x20	100
20, 21, 22	Cooper " " Furnace	Philipsburg	20x55, 18x42, 22x55	1856, 7,041
23, 24	Durham " " "	9 miles S. of Easton, Pa.	30x40, 14x40	1855–56, 10,271
25	South Easton " Furnace	Easton	14x12, 48 high.	1856, 4,677½
26, 27, 28	Glendon " "	"	18x14, 12x14, 14x16 50 4 45 45	1856, 19,162½
29, 30, 31, 32	Allentown Iron Co's Anthracite Steam Furnaces	Allentown, Pa	12x16, 45x50	1856, 17,578
33, 34, 35, 36, 37	Lehigh Crane Iron Co's " "	3 m. N. W. Allentown, Pa.	11, 13, 16, 18, 18 47 55	1857, 20,384
38, 39	The Thomas " " "	4 m. " " "	13, 60	1857, 18,096
40	Lehigh Valley " " "	5 m. " " "	14, 45 high.	1857, 4,465
41	Poco Anthracite (Water) Furnace	Parryville, Carbon Co.	14x40	1857, 3,217
42	Mauch Chunk Anthracite "	Mauch Chunk	9x33	1857, ——
43	Pioneer Anthracite Steam "	Pottsville, Schuylkill Co.	13x36	1857, 3,849
44	Leesport Iron Co's Anthracite Steam Furnace	Leesport, Berks Co	14x45	
45	Moslem Anthracite Furnace	7 m. E. of Leesport, Berks Co.	9x34	
46, 47	The Robesonia Iron Works	12 miles W. of Reading.	9½x30, 14x40	1856, 2,141

Anthracite Blast Furnaces of the United States—Continued.

Number.	NAME.	Locality.	Sizes.	Product.
48	Reading Anthracite Furnace	Reading, Berks Co.	18x49	1856, 5,972¼
49, 50	Henry Clay " Steam Furnaces	" "	14x38 & 15x38	1856, 8,747
51	Keystone " Furnace	Birdsboro, "	12x45	1856, 3,885
52	Hopewell " Steam Furnace	Hopewell, "	12x36	
53, 54, 55	Phœnix Iron Works	Phœnixville, Chester Co.	12x14x38	1857, 11,772
56	Montgomery Anthracite Furnace	Port Kennedy, Mont. Co	15x42	
57	Lucinda " Steam Furnace	Norristown "	11x34	1857, 2,000
58, 59	Swede Iron Co's " " "	2 m. b. Norristown "	14x42x50	1856, 5,038
60	Plymouth " " "	4 " " "	11x36	1855, 4,061
61	Merion " " "	4 " " "	12x38	1856, 4,462¼
62	Spring Mill " " "	12 miles from Philadelphia	12x40	1857, 4,511
63	Wm. Penn " " "	" " "	11¾x37	1857, 4,264
65	Safe Harbor " " "	Safe Harbor, Lanc. Co	14x45	1856, 4,383¼
66	Conestogo " " "	Lancaster, Pa	11x36	1856, 3,640
67, 68	Shawnee " " "	2 miles S. E. Columbia	10x33, 14x17	1856, 3,304
69	Cordelia " " "	2 " E. of Lancaster	10½x35	1857, 3,470½
70	St. Charles " " "	Columbia, Pa	14x45	1855, 4,530
71	Henry Clay " " "	2 miles above Columbia	10x32	1855
72	Chickeswalungo " " "	½ " " "	10¾x32	1855, 3,209
73	Eagle " " "	Marietta, Lancaster Co.	12x35	1857, 4,332
74	Donegal " " "	" "	12x35	1855, 4,747
75, 76	Marietta " " "	" "	11x36x10x30	1857, 3,560¼ & 2,469¾
79	Cameron " " "	Middletown	14x35	1857, 2,575
80	Harrisburg " " "	Harrisburg	11x40	1855, 3,805
81	Paxon (late Keystone,) Anthracite Steam Furnace	"	16x43	1855, 4,504
82	Union Deposit Anthracite Steam Furnace	1 mile east Harrisburg	11x39	1857, 2,294
83	New Market " " & Water Furnace	Millerstown	9x30	1856, 728
84	Dudley " " Furnace	½ mile north Lebanon	13½x36	1856, 3,628
85, 86, 87	N. Lebanon " " "	1 " " "	12x35, 14x35	1856, & '54, 4,602 & 3,868
88, 89	Cornwall " " "	5 " south "	12x38, 14x38	1856, 10,000 about.
90	Stanhope " " "	2 " from Pinegrove	10x33	1856, 1,874
91	Duncannon " " "	13 " above Harrisburg	14x40	1854, 1,871
92	Lewistown " " "	Lewistown	11x37	1854, 3,496
93	Hope " " "	7 miles above Lewistown	12x39	1856, 900
94	Shamokin " " "	Shamokin	12x45	1856, 2,465

95	Chulasky Anthracite Steam Furnace	3 miles from Danville	8x42	1857, 4,645¼
96	Franklin " " "	3 " N.W. "	9x32	1854, 1,660
97, 98, 99	Montour Iron Co's Anthracite Steam Furnace	Danville	17x35	1857, 5,517, 5,361, 3,271
100	Columbia " " "	½ mile from Danville........	10x36	1857, ,3371¼
101	Roaring Creek " Water-power Furnaces..	Roaring Creek	10x30	1856, 2,350
102	Bloom " Steam Furnace.	Bloomsburg	14x50	1857, 5,793½
103, 104	Irondale " Water "	Near Bloomsburg	12x35	1857, 5,830½, 6,161¼
105	Henry Clay " Steam "	Lightstreet, Columbia Co....	9x32	1854, 1,682
106	Williamsburg " " "	½ m. N. of Lightst't "	8x38	1855, 1,200
107	Hunlack's Creek " " "	12 miles bel. Wilkesbarre....	11x40	1857, 1,900
108	Wyoming Iron Co's " " "	½ mile S. W. of " ...	9x32	1855, 966
109, 110, 111, 112	Lackawanna Iron & Coal Co's Anthracite Steam Furnace.	Scranton....................	15, 17, 18, 20x43	1856, 5,456, 3,337, 3,330, 4,530
114	Margaretta Anthracite Steam Furnace................	½ mile bel. Williamsport.....	13x36	1856, 720
115	Mill Halls Iron Co's Anthracite Water Furnace	Bald Eagle Creek...........	10x32	
116, 117	Rough and Ready " Steam "	Havre de Grace, Md.........	9x30	1856, 1,265
118	South Baltimore " Water "	Baltimore...................	10x33	1856, 2,600
119	Ashland Iron Co's Anth. Steam & Water "	15 miles from Baltimore.....	11x32	1856, 4,215, 1854, 2,573½
120	Oregon Anthracite Steam Furnace....................	3 " north "	11x36	1855, 4,419½
77, 78	Middletown " " "	Middletown	12½x33x36	1856, 3,420½, & 2,261
113	Union " " "	4 miles below Lewistown.....	15x45	1856, 3,599½

Bloomeries and Forges.

New Jersey.

No.	Name.	Locality.
28	Patterson	Patterson.
29	Bloomingdale	Bloomingdale.
30	Charlottenburg	Passaic county.
31	Smith's	Bloomingdale.
32	Turner's	Passaic county.
33	Stockholm	Stockholm.
34	Methodist	
35	Herring Bone	Passaic county.
36	Windham	"
37	Stony Brook	Stony Brook.
38	Decker's	"
39	Dixon's	Middle Brook.
40	Powerville	Powerville.
41	Old Boonton	Boonton.
42	Troy	
43	Durham	Beaver Brook.
44	Splitrock	Beaver Lake.
45	Stickell's Meridian	Beaver Brook.
46	Richter's	"
47	Beach Glen	Beaver Run.
48	Rockaway	Rockaway.
49	Bloomary	"
50	Denmark	"
51	Middle	"
52	Washington	"
53	Valley	"
54	Lower Longwood	Valley Forge.
55	Upper Longwood	11 miles from Rockaway.
56	Hard Bargain	Petersburg.
57	Petersburg	14 miles from Rockaway.
58	Swedeland	Milton.
59	Russia	Near Milton.
60	Hopewell	18 miles from Rockaway.
61	Canistear	Sussex county.
62	Sparta	Sparta Centre.
63	Eagle	"
64	Morris Iron Works, 1	East of Sparta.
65	" " 2	"
66	Columbia	Lubber Run.
67	Roseville	"
68	Lockwood	"
69	New Andover	Near Stanhope.
70	Shippensport	"
71	Mount Olive	6 miles from Stanhope.
72	Barletsville	" "
73	Welsh's	Bartleysville.
74	Budd's, No. 1	3 miles from Chester.
75	" No. 2	3½ " "

Pennsylvania.

No.	Name.	Locality.
75.5	Bristol	Bristol.
76	Oxford	Philadelphia.
77	Norris	"
78	Fairhill	"
81	Pencoyd	6 miles from Philadelphia.
82	Green Lane	Perkiomen Creek.
83	Glasgow	1 mile from Pottstown.
84	Mount Pleasant	Perkiomen Creek.
85	District No	20 miles from Reading.
86	No. 2	Pine Creek.
87	Rockland, No. 1	Near Kutztown.
88	" No. 2	"
89	Oley	12 miles from Reading.

Pennsylvania—Continued.

No.	Name.	Locality.
90	Spring	Manatawny Creek.
91	Dale	Iron Dale.
92	Speedwell, No. 1	2 miles from Reading.
93	" No. 2	2 " "
94	Exeter	5 " "
95	Seidell's	4 " "
96	Keystone	Reading.
97	Reading	"
98	Franklin	Allegheny Creek.
99,100	Gibralta, H. 2	"
101	Dorwell	6 miles south Reading.
102	Coventry	Coventry.
103	Isabella	16 miles from Pottstown.
104	Springton	7 miles from Downington.
105	Mary Ann	2 " "
106	Hibernia	4 miles from Coatesville.
107	Greenwood	Pennington.
109	Poole	20 miles from Lancaster.
110	Windsor	20 " "
111	Spring Grove	20 " "
112	Brooke	Gap Station, Lancaster county.
113	Sadsbury, 1	Penningtonville.
114	" 2	"
115	Ringwood	6 miles from Penningtonville.
116	Pinegrove	16 " "
117	White Rock	South of "
119	Colemanville	12 miles from Lancaster.
120	Mentic	Colemanville.
121	Castlefin	30 miles from York.
122	Woodstock	5 " Wrightsville.
125	Bushhill	Easton.
126	Maiden Creek	5 miles from Harrisburg.
127	Mount Airy	10 " "
128	Northkill	8 " "
129	Chamming	15 miles from Reading.
130	Lebanon	Lebanon.
131	Union	12 miles from Lebanon.
132	Monroe	12 " "
133	Newmarket	12 " "
135	Liberty	7 miles from Harrisburg.
136	Carlisle	4½ " Carlisle.
137	Laurel	14 " "
139	Caledonia	10 " Chambersburg.
140	Mount Alto, No. 1	13 " "
141	" No. 2	18 " "
144	Valley	15 " "
145	Carrick	19 " "
146	Warren	7 " Hancock.
147	Ashland	Lehigh Gap.
148	Maria Forge	Poce Creek.
149	Weissport	Weissport.
150	Pennsville	Lizard Creek.
151	Tamaqua	Tamaqua.
155	Mount Hebron	3 miles from Ashland.
156	Oakdale	Oakdale.
157	Stonydale	Stony Brook.
158	Nescopec	Nescopec Creek.
159	Catawissa	Catawissa.
160	Pasnias	3 miles from Shamokin.
161	Berlin	Clinton.
162	Freedom	7 miles from Lewistown.
163	Brookland	Waynesburg.
164	Milinda	4 miles from Obisonia.
165	Lemnos	5 " Hopewell.
166	Bedford	5 " "
167	Hepburn	12 " Williamsport.
168	Heshbon	5 " "

Pennsylvania—Continued.

No.	Name.	Locality.
169	Washington	13 miles from Bellefonte.
170	Howard	12 " "
171	Eagle	5 " "
172	Milesburg	2 " "
173	Bellefonte	Bellefonte.
174	Rock	6 miles from Bellefonte.
175	Coleraine, 12 & 3	3 " Spruce Creek.
176	Elizabeth	Spruce Creek.
177	Bane, 1 & 2	3 miles from Petersburg.
178	Juniata	Petersburg.
179	Juniata Iron Works	"
180	Stockdale	Spruce Creek.
181	Cold Spring	½ mile west Tyrone.
182	Tyrone	2 miles from Cold Spring.
184	Mary Ann, 1 & 2	Bell's Mills.
185	Etna	5 miles from Alexandria.
186	Cove	17 " Hollidaysburg.
187	Franklin	2 " Williamsburg.
188	Maria (Lower)	7 " Hollidaysburg.
189	" (Middle)	¼ " "
190	" (Upper)	8 " "
191	Martha	7 " "
192	Allegheny	6 " "
459.8	West Point	Pittsburg.
459.2	Pennsylvania	"
459.4	Sheffield	"
459.6	Duquesne	"

Maryland.

No.	Name.	Locality.
119	Octorara	8 miles from Port Deposit.

Rolling Mills.

Pennsylvania.

No.	Name.	Locality.
45	Lehigh	South Easton.
46	Oxford Iron and Steel Works	Philadelphia.
47	Kensington	"
48	" Iron Works	"
49	Penn	"
50	Treaty	"
51	Fairmount	"
52	Fountain Green	"
53	Flatrock	"
54	Penceyd	Flatrock.
55	Cheltenham	Tacony Creek.
55.5	Schuylkill Iron Works	12 miles from Philadelphia.
56	Conshohocken	13 " "
57	Pennsylvania	13 " "
58	White Marsh Iron Works	Near last two.
59	Norristown, No 1	Norristown.
60	" Nail Factory, 2	"
61	" No. 3	"
62,3,4	Phœnix	Phœnixville.
66	Thorndale	Downingtown.
67	Rokeby	Buck Run.
68	Brandywine	Coatsville.
69	West Brandywine	Wagontown.

Pennsylvania—Continued.

No.	Name.	Locality.
70	Laurel	Buck Run.
71	Viaduct	Midway Station.
72	Valley Iron Works	Coatsville.
73	Hibernia	4 miles from Coatsville.
74	Pleasant Garden	Chester county.
75	Pinegrove	Lower Oxford Township.
76	Pottstown	Pottstown.
77	Pine	Manataury Creek.
78	Birdsboro'	Hay Creek.
79	Gibralta	5 miles from Reading.
80	Reading	Reading.
81	Neversink	"
82	McIlvanes	"
83	Keystone	"
85	Pottsville	Pottsville.
86	Palo Alto	"
87	Weissport	Weissport.
88	Lackawanna	Scranton.
88.5	Danville	Danville.
89	Rough and Ready	11 miles east Northumberland.
90	Montour, No. 1	Danville.
91	" No. 2	"
92	Duncannon	Sherman's Creek.
93	Fairview	Fairview.
94	Central	Harrisburg.
95	Harrisburg	"
96	Columbia	Columbia.
97	Safe Harbor	10 miles from Lancaster.
98	Colemansville	12 " "
99	Heshbon	5 " Williamsport.
100	Cresent	11 " "
101	Blossburg	New York, manager in Pennsylvania.
102	Howard	Lick Run.
103	Hecla	Bellefonte.
104	Milesburg	Milesburg.
105	Eagle	Near Bellefonte.
106	Bellefonte	Bellefonte.
107	Portage	Hollidaysburg.
108	Juniata	Alexandria.
109	Mont Alto	9 miles south-east Chambersburg.
145	Cambria	Johnstown.
146	Fairchance	Uniontown.
147	Brownsville	Brownsville.
148	McKeesport	McKeesport.
149	American	Birmingham.
150	Western Tack Factory	"
151	Hecla	"
152	New, R. M.	"
153	Sligo	Pittsburg.
154	Clinton	"
155	Pittsburg	"
156	Sheffield	"
157	Eagle	"
158	Pennsylvania Forge	"
159	Kensington	"
160	Pittsburg Steel Works	"
161	Wayne	"
162	Sable	"
164	Juniata	"
165	Duquesne	"
166	Lorentz	3 miles from Pittsburg
167	Etna	4 " "
168	Vesuvius	5 " "
169	Kittanning	42 " "
170	Brady's Bend	Brady's Bend.
172	Sharon	Sharon.
173	Orizaba	New Castle.
174	Cosalo	"

New Jersey.

No.	Name.	Locality.
35	Christman & Co.	Jersey City.
36	" "	2 miles S. W Jersey City.
37	Charlottenburg	11 miles north Rockaway.
38	Pompton	6 miles east "
39	Powerville	4 miles east "
40	Rockaway	Rockaway.
41	Boonton	19 miles from Newark.
42	Dover	Dover Station.
43	Trenton	South Trenton.
44	Cumberland	Bridgeton.

Delaware.

No.	Name.	Locality.
111	Wilmington	Wilmington.
112	Diamond	"
113	Delaware	5 miles north-west Wilmington.
114	Marshall	4½ " " "

Maryland.

No.	Name.	Locality.
115	Elk	5 miles north Elkton.
116	West Amwell	2 " "
117	North East	Baltimore & Wilmington R. R.
118	Shannon	Baltimore.
119	Octorara	5 miles north Port Deposit.
120	Joppa	15 miles from Baltimore.
121	Baltimore	Baltimore.
122	Canton 1	2 miles from Baltimore.
123	" 2	2 " "
124	Baltimore Forge	Baltimore.
125	Avalu	Relay House.
126	Antietam	7 miles above Harper's Ferry.
127	Mount Savage	8 miles west Cumberland.

Charcoal Furnaces.

Maryland.

No.	Name.	Locality.
286, 287, 288	Mount Savage	9 miles north-west Cumberland.
289	Lonaconing	Lonaconing.
82	Lagrange	30 miles north Baltimore.
81	Principio	Baltimore Railroad.
83	Sarah	24 miles north Baltimore.
84	Hartford	25 miles north-west Baltimore.
85	Locust Grove	Stemer's Run Station.
86	Gunpowder	14 east Baltimore.
87	Chesapeake	Baltimore.
88	"	"
89	Cedar Point	2 from Baltimore.
90	"	2 " "
91	Maryland	Baltimore.
92	"	"
93	Laurel	"
94	Cecelia	"
95	Elk Ridge	Elk Ridge Landing.
98	Muirkirk	Prince George County.
99	Elba	31 west Baltimore.

Maryland—Continued.

No.	Name.	Localily.
100	Catoctin	12 from Frederick.
101	"	12 " "
102	Antietam	7 miles above Harper's Ferry.
103	Greenspring	3 miles north from Clear Spring.

Pennsylvania.

45	Lehigh	Lehigh County.
46	Maria	2 miles from Weissport.
47	Pennville	Lehigh County.
48	Hampton, No. 1	12 miles south-west Allentown.
49	Mary Ann	5 miles from last.
50	Oley	1½ north-east Reading.
51	Sally Ann	5 miles south Kutztown.
52	Mount Laurel	6 miles north-east Reading.
53	Maiden Creek	20 miles north "
54	Mount Penn	2 miles from "
55	Hampton, No. 2	2 miles south Birdsboro'.
56	Joanna	9 miles south-west Birdsboro'.
57	Hopewell	South-east corner Berks County.
58	Warwick	1 miles west Phœnixville.
60	Mount Hope	6 miles south Lebanon.
61	Colebrook	10 miles south-west Lebanon
62	Cornwall	6 miles south Lebanon.
63	Mananda	1 mile South Manada Gap.
64	Georgianna	1 mile above Dauphin.
66	Conowingo	16 miles from Lancaster.
67	York	1 mile below Colemansville.
68	Margaretta	4½ south Wrightsville.
69	Chestnut Grove	Near Carlisle.
70	Carlisle	"
72	Pinegrove	14 miles south-west Carlisle.
73	Big Pond	6 miles east Shippensburg.
75	Caledonia	10 miles east Chambersburg.
76	Mont Alto	9 miles south-east Chambersburg.
77	Carrick	8 miles north Loudon.
78	Valley	2 " "
79	Franklin	7½ miles from Chambersburg.
80	Warren	1½ north State Line.
81	Principio	Baltimore Railroad.
104	Shickshinny	17 miles below Wilkesbarre.
105	Catawissa	5 miles east Catawissa.
106	Penn	½ "
107	Esther	3½ miles south
108	Parinas	miles north Shamokin.
109	Forest	Union County
110	Berlin	4 miles south Hartleton.
111	Beaver	20 miles east Lewiston.
112	Heshbon	Lycoming Creek.
113	Washington	Nittany Valley.
114	Howard	10 miles north-east Bellefonte.
115	Hecla	7 miles south-east "
116	Eagle	3 miles north-east Millersburg.
117	Logan	2 miles south-east Bellefonte.
119	Centre	9 miles south-west "
120	Juliana	10 " " Millersburg
121	Martha	5 from Bellefonte.
122	Monroe	4 miles south-east Pinegrove.
123	Huntingdon	4 miles north Spruce Creek.
124	Pennsylvania	10 miles north-east Spruce Creek.
125	Brookland	McVeytown Station.
126	Matilda	Mount Vernon Station.
127	Greenwood	14 miles north-west Lewistown.
128	Mill Creek	4 miles south-east Huntingdon.
129	Edward	Vineyard Mills.
130	Rockhill	¾ south-east Orbisonia.
131	Malinda	15 m. S.W. Mount Union Station.

Pennsylvania—Continued.

No.	Name.	Locality.
132	Bald Eagle	5 miles from Tyrone.
133	Ætna	25 below Hollidaysburg.
134	Elizabeth	Logan Valley.
135	Blair	2¼ north-east Altoona.
136	Allegheny	1¾ from Altoona.
137	Bennington	7 west Hollidaysburg.
138	Gaysport	Hollidaysburg.
139	Hollidaysburg	"
140	Frankstown	Frankstown.
141	Gap	McKee's Gap.
142	Juniata	Williamsburg.
143	Springfield	5 miles south Williamsburg.
144	Rebecca	12 m. S.E. Hollidaysburg.
145	Bloomfield	13 m. south "
146	Sarah	13 from "
147	Lemnos	2 miles west Hopewell.
148	Rough and Ready	20 miles south Huntingdon.

New Jersey.

No.	Name.	Locality.
39.6	Renton's	1 mile north Newark.
39.7	"	1 " "
40	Freedom	5 " Pompton.
41	Pompton	Pompton.
42	Wayayanda	Sussex County.
43	Franklin	Franklin.
44	Oxford	Oxford.
149	Millville	Millville.

Anthracite and Charcoal Furnaces, Bloomaries, Forges, Refineries and Rolling Mills in the United States.

From J. P. Lesley.—1858.

States.	Anthracite Furnaces.	Charcoal and Coke.	Abandoned Furnaces.	Bloomary Forges.	Abandon'd Bloomaries.	Refinery Forges.	Abandoned Refineries.	Rolling Mills.	Abandoned.
Maine		1						1	
New Hampshire		1				1			
Vermont		5		5				1	
Massachusetts	3	7				5	1	19	
Rhode Island								2	
Connecticut	1	14				6		5	
New York	14	29	6	42	1	3	2	11	5
New Jersey	4	6	12	48	29	2		10	1
Pennsylvania	93	150	102	1	3	110	44	91	5
Delaware			1					4	
Maryland	6	24	7					13	
Virginia		39	56			43		12	
North Carolina		3	3	36				1	
South Carolina		4	4	2				3	1
Georgia		7	1	4				2	

Anthracite and Charcoal Furnaces, &c.—Continued.

STATES	Anthracite Furnaces.	Charcoal and Coke.	Abandoned Furnaces.	Bloomary Forges.	Abandon'd Bloomaries.	Refinery Forges.	Abandoned Refineries.	Rolling Mills.	Abandoned.
Alabama	......	3	1	14	......	......	......	......	....
Tennessee	......	41	33	50	2	9	3	3	....
Kentucky	......	30	17	......	......	4	9	8	2
Arkansas	......	......	......	1	......	......	......	......	....
Missouri	......	7	......	......	......	3	......	5	....
Illinois	......	2	......	......	......	......	......	1	1
Indiana	......	2	3	......	......	......	......	1	....
Ohio	......	54	26	......	......	......	5	15	....
Michigan	......	7	......	3	......	......	......	2	....
Wisconsin	......	3	......	......	......	......	......	......	....
Total	121	439	272	203	35	186	64	210	15

In working order, 1,159	**Furnaces, 560**	**Forges, 389**	**Rolling Mills, 210**
Abandoned...... 386	**" 272**	**" 99**	**" 15**
In all.......1,545	**Furnaces, 832**	**Forges, 488**	**Rolling Mills, 225**

APPENDIX E.

PETROLEUM.

As shown in the first pages of this report, both petroleum and coal are of vegetable origin—the former from the deposit of salt water plants, and the latter from fresh water plants.

In the formation of the continents from the sea, two great periods in the growth of vegetation naturally followed; first, the rank growth of salt water plants, of the almost limitless marshes of the Chemung period; and secondly, the fresh water plants of the upheaved inland seas of the Carboniferous; petroleum being as much the offspring of the former as coal is of the latter—both the representatives of their respective periods. We find that the third sand rock of Oil creek, dipping south, passes from 500 to 600 feet below the coal measures; and in the Mahoming and Eastern Ohio oil regions, the three oil-bearing rocks are beneath the lowest coal beds. Underlying the lowest oil rocks, there is a stratum of limestone of unknown thickness.

The three oil-bearing sand rocks are porous, and filled with numerous cells and fissures, between which channels of communication exist, as new wells often rob their neighbors, leaving them valueless. In Pennsylvania, the third sand rock lies at the several depths of from 1,000 to 1,200 feet, at Titusville; 1,100 feet on the Allegany river, near Oil city; 550 feet between Shaffer and Rouseville, on Oil creek; 650 feet on Cherry run; and 600 on Pithole, the surface being at the Frazier well 700 feet above Oil creek. The rise of stratification from the Allegany river to Lake Erie has been found to be the fraction of one degree. Humboldt estimated that the area of sand rock in the United States covered 200,000 square miles. The specific gravity of petroleum varies from .73 to .878.

Extensive deposits of petroleum are known to exist in the States of New York, Pennsylvania, Ohio, Virginia, California, Michigan and Nevada; and abroad, along the shores of the Azof and Caspian seas, Trinidad, Burmah, Persia, Island of Samos, Mexico, Canada, France and Russia.

The following statement shows the number of gallons of petroleum exported from the United States:


with Balt. & Ohio R. R. at Grafton
Pennsboro
lenborough
North Fk. Hughes R.
Harrisville
Ritchie C.H.
Solus
Brushy Fk.
Murphy's Settlement
I E C O.
Indian Cr.
Woods Mills
South Fork
Grass Cr.
Leather Bark Cr.
Y
Staunton Turnpike
Scale 3 Miles to the Inch

1861.	Total gallons exported		1,194,682
1862.	do	do	10,887,701
1863.	do	do	28,162,191
1864.	do	do	31,643,196

The above was sent to Great Britain, Antwerp, Marseilles, Havre, Bremen, Hamburgh, Rotterdam, South America, Spain, Cuba, Italy, Cronstadt, Mexico, Portugal, Trieste, Australia, British Provinces and British West Indies.

Western New York.

Indications of extensive oil deposits have been discovered in Ontario, Cattaraugus and Allegany counties. About thirty wells are being sunk near Bristol, Ontario county.

The strata met with in these oil regions descending are: Portage group, forming the hills 600 to 800 feet thick; Genesee slate, 150 feet; Hamilton group and Marcellus slate, together, from 600 to 800; carboniferous limestone, 50 to 150 feet, and the Onondaga salt group 800 to 1,000 feet thick.

Pennsylvania.

The poorest oil and largest flows have been found on Oil creek, between Shaffer and Rouseville. The best oil and lightest flows are found along and on the southeast side of the Allegany river, French and Sugar creeks to six and eight miles above Cooperstown, Oil creek between Shaffer and Oil lake, and the region along Pine creek to Tideirete.

The oil from Oil creek varies from forty to fifty degrees, Beaume; Allegany river, from thirty-four to thirty-nine; and French Creek from thirty to thirty-one and a half degrees. The oil is reached above Gordon's run at a depth of 120 feet; below President, 300 feet; Oil creek, below Shaffer's, about 520 feet; Cherry run, 615 feet; Pithole, 620 feet; Titusville, 420 feet, and near Franklin, 440 feet. The third sand rock, from which the largest flows are obtained, has only been reached on Oil creek, Cherry run and Pithole, below the line of Shaffer's.

The strata on Oil creek, met with in descending, are shales of different colors and hardness, with three distinct layers of sand rock, each from twenty to thirty feet thick, lying at the several depths of two hundred, three hundred and fifty and five hundred and fifty feet. One well, in descending, encountered one hundred and sixty feet slate rock, thirty feet sand rock, one hundred and twenty feet soap rock, ten to twenty-five feet second sand rock,

one hundred and thirty feet soap rock, striking the third sand rock at a total depth of four hundred and sixty feet.

It is seldom neighboring wells strike oil at the same depth, and a chance out of many of striking it at all. Oil creek has proved the most reliable. The streams and runs in the oil regions are walled in between hills, varying in abrupt height from two hundred to one thousand feet, overgrown with timber and ragged with rocks and precipices.

The existence of petroleum was known in Pennsylvania, and used for medicinal purposes as early as 1803. In 1853, Mr. Geo. H. Bissell submitted a specimen to Prof. Silliman, which was pronounced by this gentleman as of great value for lubricating purposes. In 1858, Mr. Bissell, in company with Mr. Eveleth, purchased a farm near Titusville, and organized a company, with Prof. Silliman as president, called the Pennsylvania Rock Oil Company. They at first endeavored to obtain the oil by surface vats, but meeting with little or no success, commenced the first Artesian well and struck oil on the 28th August, 1859, at a depth of sixty-nine and a half feet, that yielded about eight barrels per day. The third well was sunk near Franklin, on French creek, near its junction with the Allegany.

In 1860 it became a business, and in 1862 more oil was produced than in any subsequent or previous year, amounting to 12,000 barrels per day. The oil territory was valued, in 1859, at $700,000; and in 1864, at $250,000,000.

The receipts at Philadelphia in 1863, were 600,000 barrels, and in 1864, 421,000. It is stated that the oil product of Pennsylvania for 1864 amounted to $56,000,000, exceeding in value the products of the iron mines.

The following statement shows the number of barrels of oil received at the Pittsburg market:

1859	7,637
1860	17,161
1861	94,102
1862	171,774
1863	175,181
1864	555,259
1865, up to March 4th	411,699

Method and Cost of Sinking Wells.

Wells are now sunk in Pennsylvania exclusively by engines. The old method (and the one mostly pursued at present in Vir-

ginia) was with spring poles, at a cost of from $3.50 to $4.00 per foot, the cost averaging with the engine only from $2.50 to $3.00. The engines used are from eight to twelve horse power, costing $1,800 and $2,400, delivered on the spot. The twelve horse power engine is generally preferred, as with this power two wells are sunk and managed at the same time, being located about seventy feet apart.

The location for sinking a well is chosen from the dip of the rock, course of stream and concentration of ravines, with indications of great disturbance by upheavals and misplacements. A derrick is then built over the spot of three-inch plank, from forty to fifty feet high, ten square at the base, and from four and a half to five feet square at the the top. The engine is located about thirty-five feet from the derrick, over which a shed is constructed to protect the fuel and machinery.

The first process is driving a cast iron tube to the first stratum of rock, which varies in depth from forty to one hundred feet. This tube is six inches inner diameter, with one inch thickness of metal, cast in sections from ten to twelve feet long, connected by abutting them together and welding over the joint a wrought iron band a quarter of an inch thick by four inches in width, which makes the joint air tight when cooled. The ends of the tubes are prepared to receive this band, thus leaving no projections at the joints. The method of driving the tube is as follows: A wooden cylinder is erected opposite the engine and at the foot of the derrick, with a wheel five feet in diameter connected by a band to a similar wheel attached to the engine, by which the cylinder is made to revolve. A cable, coiled around the cylinder, passes up through a pully block at the top of the derrick, and attached to the ram (an oak timber seventeen feet long and sixteen inches square); the latter is raised and dropped upon the tube by tightening and suddenly loosening the cable by a man stationed with one end of the cable at the cylinder. The end of the tube is protected by a thick iron cap, that plays loosely under the blows of the hammer. The tube is cleared out by a sand pump six feet long, with a valve at the bottom, which, when filled, is drawn up.

The ram, with its guides, are now removed, and the drilling is commenced. A post is set in the ground midway between the well and engine, upon which a walking beam is fixed, one end connected by a vertical rod with a crank attached to the engine,

and the other to the cable or drill. A screw about four feet long is attached to the cable at the end of the walking beam, for adjusting the length of cable as the well is deepened. Two men are required to keep the drill constantly revolving, changing the drill and handling the sand pump that removes the drillings every three to four feet. The drill and bar attached is about thirty-five feet long, weighing from seven hundred to eight hundred pounds. The cable from the drill to the walking beam is from one and a half to two inches diameter. The drill proper is about four feet long, and weighs from seventy to one hundred pounds, thickened and sharpened at the end to four and four and a half inches wide. After the well is down it is tubed with two-inch gas pipe. A seed bag is let down surrounding the tube, which, when saturated, swells and shuts off the water from springs met with in descending, and the surface waters.

The average cost in sinking the deepest wells is about $6,000, and the lowest cost for a well six hundred and ten feet deep is about as follows:

One 12-horse power engine, delivered	$2,400
Six hundred feet depth of well at $2.75 per foot	1,677
Tools	375
Derrick	200
Sheds	350
Total	$5,002

It takes on an average six weeks to sink and tube a well of the above depth; some days only twenty inches and others from eight to twenty feet are accomplished.

All the producing wells have more or less tankage, each tank holding from three hundred to twelve hundred barrels. The Reed well has a tankage for 3,000 barrels, and the Coquette 20,000 barrels. As the tanks are filled the oil is drawn off by a faucet at the bottom into barrels.

The following statement shows the present condition of the original and largest oil-bearing farms in Oil creek:

NAME OF FARM.	No. of acres.	New wells going down.	Total number of wells down.	Number of producing wells.	Present yield of bbls. per day.
Graff & Hasson farm (near Oil city)	300	100	......	5	5
Clapp farm	......	50	60	15	200
Cornplanter tract	......	30	......	8	65
Ham. McClintock farm	400	......	55	7	100
Buchanan farm	400	......	100	25	300
John McClintock farm	150	45	......	30	200
Widow McClintock farm	......	......	40	17	300
Rynd farm	260	.....	19	5	100
Blood farm	210	50	12	5	40
Blood farm	220	50	28	18	300
Tarr farm	209	62	43	27	750
Story farm	300	......	35	16	450
Dalzell property	100	......	16	5	125
Wash. McClintock farm	207	45	18	16	500
Egbert farm	38	......	25	10	1000

The following statement shows the characteristics of the most important wells in the center of the oil region of Pennsylvania:

NAME OF WELL.	LOCATION.	Depth of well—feet.	When oil commenced flow'g.	Yield when str'k—bls. per day.	Now yielding—bbls. per day.
Brawley	A. Buchanan farm, Oil creek	503	1861	600	.....
Van Slyke	Widow McClintock farm, Oil Creek	500	1861	600	50
Bushnell	Blood do do	505	1861	400	.....
Old Phillips	Tarr do do	485	1861	450	50
Big Phillips	do do do	480	1861	3,500	325
Woodford	do do do	......	1861	1,500	50
Empire	Funk do do	......	1861	2,500	110
Noble	Farrell do do	470	1863	1,900	.....
Sherman	Sherman Flats, do	......	1861	1,500	50
Jones	Tarr farm, do	......	1862	400	.....
W. McClintock	W. McClintock farm, do	......	1862	800	.....
Chimney	Story do do	......	1863	300	.....
Maple Shade	Egbert do do	......	1863	400	80
Jersey	do do do	505	1864	400	235
Coquette	do do do	519	1864	600	400
Frazier	N. S. Co., Pithole run	......	1864	250	235
Reed	Duff tract, Cherry run	610	1864	280	280
Yankee	do	606	......	50	50
Grumminger	do	600	......	150	100
Ram Cat	Story farm, Oil creek	......	1864	300	80
Dale & Morrow	Cochran farm, two miles below Franklin	440	1861	240	40
Hoover	Hoover Island, below Franklin	......	......	......	100
Plumer & Hoover	Opposite do do	427	......	......	50
Hammond	Widow McClintock, Oil creek	510	1864	500	250
Excelsior	Smith farm, four miles below Franklin	424	......	40	40
Economite	Tideante, Allegany river	120	......	20	20
Railroad	Shaffer farm, Oil creek	......	......	......	45
Graff & Hasson	Graff & Hasson farm, near Oil city	......	......	12	12

The large flowing wells generally stop flowing in twenty-five or thirty months, when a yield of from twenty to one hundred barrels a day is obtained by pumping.

Ohio and Western Virginia.

Indications of extensive deposits of oil have been discovered on Reedy, Burning Springs, Cow, Calf, Steer, Leading, Duck, Paw Paw, Goose, Little Muskingum and Kanawha, Horse Neck, Long Moose, Fifteen, Eight, Rawson, Newell's, Bull and French creeks, and other streams in Wood, Wirt, Ritchie, Roans and Gilmer counties.

Bull run is the best developed, and thus far the most productive. The wells on Cow run have produced largely. Newell's run is now under development, and much is expected from outward indications. There are five producing wells on Horse Neck creek, a branch of Bull creek. Cow and French creeks are in great favor. The Coney & Gilfillan well yields from seventy-five to one hundred barrels; Prime well, ten to twelve barrels per day. These wells are situated on Horse Neck, Wood county. Several wells are going down on Cow run; one well yields ten barrels per day. The Newton well has produced 17,000 barrels, and still yielding, and the Dutton well, on Duck creek, 19,000 barrels. There are many fine producing wells on Paw Paw, Long Moose, Fifteen and Eight-Mile creeks. Twenty-four wells have been put down from Bull to French creeks, and seventy more are being sunk. A well was struck on Horse Neck that yielded eight hundred barrels per day, and one on Rawson of thirty-five barrels. There are over 2,500 wells going down this spring in Western Virginia.

The oil regions of Virginia bear a resemblance to those of Pennsylvania, while Ohio appears less disturbed and broken. The oil rocks in Virginia appear to lie at a depth of from one hundred and fifty to two hundred and fifty feet. In the region of Burning Spring and Little Kanawha, the average depth to the oil is two hundred and forty feet, and about twenty-eight degrees Beaume. Specimens from borings in Lawrence county, at Edenburg, were: 80 feet superficial drift, 200 feet sandstones and shales, 50 feet white sand rock, 45 feet shales and slate, charged with oil and gas, 75 feet white sand rock, striking the great oil rock strata at a total depth of 448 feet.